PROJECT MANUAL

HOUSTON COUNTY
DEPARTMENT OF HUMAN RESOURCES

Dothan, Alabama

for

Houston County Public Building Authority
(Local Funds)

ISSUED FOR BID



Prepared By

GMC

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www.gmcnetwork.com

GMC PROJECT NUMBER: ABHM250019

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ADVERTISEMENT FOR PREQUALIFICATION AND BIDS

PREQUALIFICATION PROPOSALS will be received via email, or other electronic transmission, on behalf of the Owner by Goodwyn Mills Cawood, LLC., at 2400 5th Avenue South, Ste. 200, Birmingham, AL 35233, for the below referenced project, until **2:00 PM Local Time, April 21, 2026.** The prequalification procedure is intended to identify responsible and competent bidders relative to the requirements of the Project. Prequalification proposal requirements may be obtained from the Architect, by request by e-mail alyssa.martin@gmcnetwork.com, to Alyssa Martin. Additional qualifications and requirements for General Contractor Bidders and separate Subcontractors are indicated in the Bid and Contract Documents.

SEALED PROPOSALS will be received only from previously PRE-QUALIFIED General Contractors by Houston County Public Building Authority, located at 462 N Oates Street, Dothan, AL 36303, Ground Floor, Commission Chambers; until 2:00 PM Local Time, May 21, 2026 for this project:

HOUSTON COUNTY DEPARTMENT OF HUMAN RESOURCES
Dothan, ALABAMA for
Houston County Public Building Authority

(LOCALLY FUNDED)

at which time and place they will be publicly opened and read.

A cashiers check or bid bond payable to Houston County Public Building Authority in an amount not less than five (5) percent of the amount of the bid, but in no event more than $10,000, must accompany the bidder's proposal. Performance and statutory Labor and Material Payment Bonds, and insurance in compliance with requirements, will be required at the signing of the Contract.

Drawings and Specifications may be examined at the Office of the Architect; Dodge Data & Analytics; Data Fax; and ConstructConnect.

Bid documents (Plans, Specifications, and Addenda) will be sent to prequalified General Contractors only from the Architect electronically with no deposit. Subcontractors should contact a General Contractor or plan room for documents.

Only General Contractors who have completed the prequalification process within the stated time limits, and which are properly licensed in accordance with criteria established by the State Licensing Board for General Contractors under the Provision of Title 34, Chapter 8, Code of Alabama, 1975, as amended, will be considered for prequalification for the Work of this project.

A **MANDATORY PRE-BID CONFERENCE** will be held at the same location as bids are to be opened, at **2:00 PM local time May 7, 2026** for the purpose of reviewing the project and answering Bidder's questions. **Attendance at the Pre-Bid Conference IS REQUIRED for all General Contractor Bidders** intending to submit a Proposal, and is highly recommended for Subcontractors. Bids from General Contractors not attending the Pre-Bid Conference will be rejected.

Per the Owner and the Alabama Department of Revenue (ADOR), Act 2013-205, the project will be bid **EXCLUDING TAXES** and will require the Contractor to complete DCM Form C-3A Accounting of Sales Tax Attachment to DCM Form C-3 Proposal Form (August 2020) which will be submitted with the Contractors Proposal at the time of the Bid. If awarded the bid, both tax exempt entity and contractor shall apply for certificates of exemption. ADOR shall issue certificates of exemption from

sales and use tax for each tax exempt project. Certificates shall only be issued to contractors licensed by the State Licensing Board for General Contractors or any subcontractor working under the same contract. Items eligible for exemption are building materials, construction materials and supplies and other tangibles that become part of the structure. ADOR will handle the administration of the certificates and the accounting of exempt purchases.

The Owner reserves the right to reject any or all proposals, to waive technical errors and/or abandon the prequalification and bid process if, in their judgment, the best interests of the Owner will thereby be promoted.

Houston County Public Building Authority
462 N Oates Street
Dothan, AL 36303

GOODWYN MILLS CAWOOD, LLC.
MEMBERS, AMERICAN INSTITUTE OF ARCHITECTS
2400 5th Avenue South, Suite 200
Birmingham, Alabama 35233
Phone: (205) 879-4462
Fax: (205) 879-4493

****

END OF ADVERTISEMENT

NOTE: For projects exceeding $50,000, this notice must be run once a week for three successive weeks in a newspaper of general circulation in the county or counties in which the project, or any part of the project, is to be performed. If the project involves an estimated amount exceeding $500,000, this notice must also be run at least once in three newspapers of general circulation throughout the state. Proof of publication is required.

DCM Form C-1; August 2020.
REVISED (GM&C): February 2021.

DRAFT AIA® Document A305® – 2020
Exhibit A

General Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by « » and dated the « » day of « » in the year « »
(In words, indicate day, month and year.)

§ A.1 ORGANIZATION
§ A.1.1 Name and Location
§ A.1.1.1 Identify the full legal name of your organization.

« »

§ A.1.1.2 List all other names under which your organization currently does business and, for each name, identify jurisdictions in which it is registered to do business under that trade name.

« »

§ A.1.1.3 List all prior names under which your organization has operated and, for each name, indicate the date range and jurisdiction in which it was used.

« »

§ A.1.1.4 Identify the address of your organization's principal place of business and list all office locations out of which your organization conducts business. If your organization has multiple offices, you may attach an exhibit or refer to a website.

« »

§ A.1.2 Legal Status
§ A.1.2.1 Identify the legal status under which your organization does business, such as sole proprietorship, partnership, corporation, limited liability corporation, joint venture, or other.

« »

.1 If your organization is a corporation, identify the state in which it is incorporated, the date of incorporation, and its four highest-ranking corporate officers and their titles, as applicable.

« »

.2 If your organization is a partnership, identify its partners and its date of organization.

« »

.3 If your organization is individually owned, identify its owner and date of organization.

« »

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.4 If the form of your organization is other than those listed above, describe it and identify its individual leaders:

« »

§ A.1.2.2 Does your organization own, in whole or in part, any other construction-related businesses? If so, identify and describe those businesses and specify percentage of ownership.

« »

§ A.1.3 Other Information

§ A.1.3.1 How many years has your organization been in business?

« »

§ A.1.3.2 How many full-time employees work for your organization?

« »

§ A.1.3.3 List your North American Industry Classification System (NAICS) codes and titles. Specify which is your primary NAICS code.

« »

§ A.1.3.4 Indicate whether your organization is certified as a governmentally recognized special business class, such as a minority business enterprise, woman business enterprise, service disabled veteran owned small business, woman owned small business, small business in a HUBZone, or a small disadvantaged business in the 8(a) Business Development Program. For each, identify the certifying authority and indicate jurisdictions to which such certification applies.

« »

§ A.2 EXPERIENCE

§ A.2.1 Complete Exhibit D to describe up to four projects, either completed or in progress, that are representative of your organization's experience and capabilities.

§ A.2.2 State your organization's total dollar value of work currently under contract.

« »

§ A.2.3 Of the amount stated in Section A.2.2, state the dollar value of work that remains to be completed:

« »

§ A.2.4 State your organization's average annual dollar value of construction work performed during the last five years.

« »

§ A.3 CAPABILITIES

§ A.3.1 List the categories of work that your organization typically self-performs.

« »

§ A.3.2 Identify qualities, accreditations, services, skills, or personnel that you believe differentiate your organization from others.

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« »

§ A.3.3 Does your organization provide design collaboration or pre-construction services? If so, describe those services.

« »

§ A.3.4 Does your organization use building information modeling (BIM)? If so, describe how your organization uses BIM and identify BIM software that your organization regularly uses.

« »

§ A.3.5 Does your organization use a project management information system? If so, identify that system.

« »

§ A.4 REFERENCES

§ A.4.1 Identify three client references:
(Insert name, organization, and contact information)

« »

§ A.4.2 Identify three architect references:
(Insert name, organization, and contact information)

« »

§ A.4.3 Identify one bank reference:
(Insert name, organization, and contact information)

« »

§ A.4.4 Identify three subcontractor or other trade references:
(Insert name, organization, and contact information)

« »

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Exhibit B

Financial and Performance Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by « » and dated the « » day of « » in the year « »
(In words, indicate day, month and year.)

§ B.1 FINANCIAL
§ B.1.1 Federal tax identification number:

« »

§ B.1.2 Attach financial statements for the last three years prepared in accordance with Generally Accepted Accounting Principles, including your organization's latest balance sheet and income statement. Also, indicate the name and contact information of the firm that prepared each financial statement.

« »

§ B.1.3 Has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, been the subject of any bankruptcy proceeding within the last ten years?

« »

§ B.1.4 Identify your organization's preferred credit rating agency and identification information.
(Identify rating agency, such as Dun and Bradstreet or Equifax, and insert your organization's identification number or other method of searching your organization's credit rating with such agency.)

« »

§ B.2 DISPUTES AND DISCIPLINARY ACTIONS
§ B.2.1 Are there any pending or outstanding judgments, arbitration proceedings, bond claims, or lawsuits against your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, or any of the individuals listed in Exhibit A, Section 1.2, in which the amount in dispute is more than $75,000?
(If the answer is yes, provide an explanation.)

« »

§ B.2.2 In the last five years has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management:
(If the answer to any of the questions below is yes, provide an explanation.)

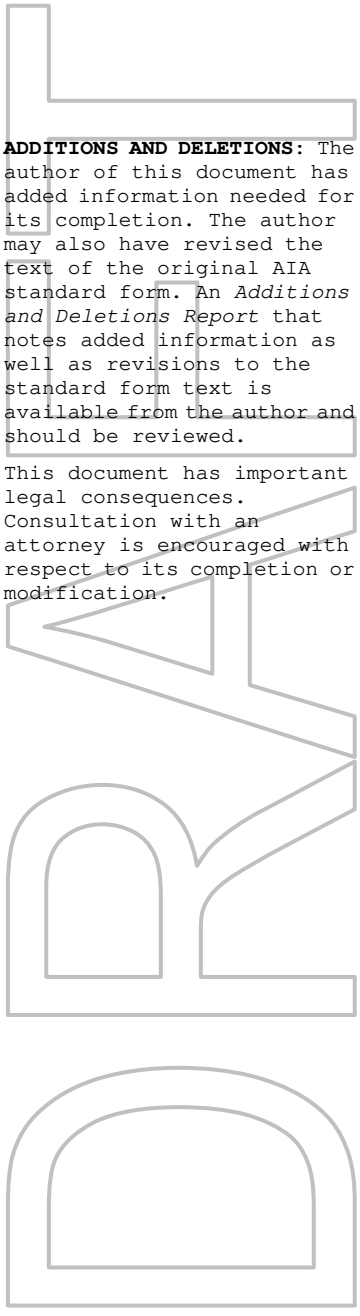
.1 failed to complete work awarded to it?

« »

.2 been terminated for any reason except for an owners' convenience?

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« »

.3 had any judgments, settlements, or awards pertaining to a construction project in which your organization was responsible for more than $75,000?

« »

.4 filed any lawsuits or requested arbitration regarding a construction project?

« »

§ B.2.3 In the last five years, has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management; or any of the individuals listed in Exhibit A Section 1.2:
(If the answer to any of the questions below is yes, provide an explanation.)

.1 been convicted of, or indicted for, a business-related crime?

« »

.2 had any business or professional license subjected to disciplinary action?

« »

.3 been penalized or fined by a state or federal environmental agency?

« »

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Exhibit C

Project Specific Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by « » and dated the « » day of « » in the year « »
(In words, indicate day, month and year.)

PROJECT:
(Name and location or address.)

« »
« »

CONTRACTOR'S PROJECT OFFICE:
(Identify the office out of which the contractor proposes to perform the work for the Project.)

« »

TYPE OF WORK SOUGHT
(Indicate the type of work you are seeking for this Project, such as general contracting, construction manager as constructor, design-build, HVAC subcontracting, electrical subcontracting, plumbing subcontracting, etc.)

« »

CONFLICT OF INTEREST
Describe any conflict of interest your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, or any of the individuals listed in Exhibit A Section 1.2, may have regarding this Project.

« »

§ C.1 PERFORMANCE OF THE WORK
§ C.1.1 When was the Contractor's Project Office established?

« »

§ C.1.2 How many full-time field and office staff are respectively employed at the Contractor's Project Office?

« »

§ C.1.3 List the business license and contractor license or registration numbers for the Contractor's Project Office that pertain to the Project.

« »

§ C.1.4 Identify key personnel from your organization who will be meaningfully involved with work on this Project and indicate (1) their position on the Project team, (2) their office location, (3) their expertise and experience, and (4) projects similar to the Project on which they have worked.

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« »

§ C.1.5 Identify portions of work that you intend to self-perform on this Project.

« »

§ C.1.6 To the extent known, list the subcontractors you intend to use for major portions of work on the Project.

« »

§ C.2 EXPERIENCE RELATED TO THE PROJECT

§ C.2.1 Complete Exhibit D to describe up to four projects performed by the Contractor's Project Office, either completed or in progress, that are relevant to this Project, such as projects in a similar geographic area or of similar project type. If you have already completed Exhibit D, but want to provide further examples of projects that are relevant to this Project, you may complete Exhibit E.

§ C.2.2 State the total dollar value of work currently under contract at the Contractor's Project Office:

« »

§ C.2.3 Of the amount stated in Section C.2.2, state the dollar value of work that remains to be completed:

« »

§ C.2.4 State the average annual dollar value of construction work performed by the Contractor's Project Office during the last five years.

« »

§ C.2.5 List the total number of projects the Contractor's Project Office has completed in the last five years and state the dollar value of the largest contract the Contractor's Project Office has completed during that time.

« »

§ C.3 SAFETY PROGRAM AND RECORD

§ C.3.1 Does the Contractor's Project Office have a written safety program?

« »

§ C.3.2 List all safety-related citations and penalties the Contractor's Project Office has received in the last three years.

« »

§ C.3.3 Attach the Contractor's Project Office's OSHA 300a Summary of Work-Related Injuries and Illnesses form for the last three years.

§ C.3.4 Attach a copy of your insurance agent's verification letter for your organization's current workers' compensation experience modification rate and rates for the last three years.

§ C.4 INSURANCE

§ C.4.1 Attach current certificates of insurance for your commercial general liability policy, umbrella insurance policy, and professional liability insurance policy, if any. Identify deductibles or self-insured retentions for your commercial general liability policy.

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§ C.4.2 If requested, will your organization be able to provide property insurance for the Project written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis?

« »

§ C.4.3 Does your commercial general liability policy contain any exclusions or restrictions of coverage that are prohibited in AIA Document A101-2017, Exhibit A, Insurance A.3.2.2.2? If so, identify.

« »

§ C.5 SURETY

§ C.5.1 If requested, will your organization be able to provide a performance and payment bond for this Project?

« »

§ C.5.2 Surety company name:

« »

§ C.5.3 Surety agent name and contact information:

« »

§ C.5.4 Total bonding capacity:

« »

§ C.5.5 Available bonding capacity as of the date of this qualification statement:

« »

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Exhibit D

Contractor's Past Project Experience

	1	2	3	4
PROJECT NAME				
PROJECT LOCATION				
PROJECT TYPE				
OWNER				
ARCHITECT				
CONTRACTOR'S PROJECT EXECUTIVE				
KEY PERSONNEL (include titles)				
PROJECT DETAILS	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work
PROJECT DELIVERY METHOD	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☑ CM advisor ☐ Other:
SUSTAINABILITY CERTIFICATIONS				

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Exhibit E

Contractor's Past Project Experience, Continued

	1	2	3	4
PROJECT NAME				
PROJECT LOCATION				
PROJECT TYPE				
OWNER				
ARCHITECT				
CONTRACTOR'S PROJECT EXECUTIVE				
KEY PERSONNEL (include titles)				
PROJECT DETAILS	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work
PROJECT DELIVERY METHOD	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☑ CM advisor ☐ Other:
SUSTAINABILITY CERTIFICATIONS				

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AIA® Document A701™ – 2018

Instructions to Bidders

for the following Project:
(Name, location, and detailed description)

THE OWNER:
(Name, legal status, address, and other information)

THE ARCHITECT:
(Name, legal status, address, and other information)

TABLE OF ARTICLES

1 DEFINITIONS

2 BIDDER'S REPRESENTATIONS

3 BIDDING DOCUMENTS

4 BIDDING PROCEDURES

5 CONSIDERATION OF BIDS

6 POST-BID INFORMATION

7 PERFORMANCE BOND AND PAYMENT BOND

8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612™–2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

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ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents, to which Work may be added or deleted by sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from, or that does not change, the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 By submitting a Bid, the Bidder represents that:

.1 the Bidder has read and understands the Bidding Documents;

.2 the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;

.3 the Bid complies with the Bidding Documents;

.4 the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;

.5 the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and

.6 the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

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§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

§ 3.1.3 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the advertisement or invitation to bid, or in supplementary instructions to bidders.

§ 3.1.4 Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

§ 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3 Substitutions

§ 3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

§ 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

§ 3.3.2.2 Bidders shall submit substitution requests on a Substitution Request Form if one is provided in the Bidding Documents.

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

§ 3.3.3 The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.4 If the Architect approves a proposed substitution prior to receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding, and Bidders shall not rely upon them.

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§ 3.3.5 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

§ 4.1.1 Bids shall be submitted on the forms included with or identified in the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed. Paper bid forms shall be executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper bid forms must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change" or as required by the bid form.

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall neither make additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to bind the Bidder.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Bid.

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

(Insert the form and amount of bid security.)

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

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§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning days after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:
(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

§ 4.3.2 Paper copies of the Bid, the bid security, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address, and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

§ 4.3.4 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.5 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

§ 4.4 Modification or Withdrawal of Bid

§ 4.4.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:
(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

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§ 5.2 Rejection of Bids

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

§ 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

§ 5.3.2 Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

§ 6.2 Owner's Financial Capability

A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 Submittals

§ 6.3.1 After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

.1 a designation of the Work to be performed with the Bidder's own forces;

.2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and

.3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

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§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.
(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

§ 7.2 Time of Delivery and Form of Bonds
§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix to the bond a certified and current copy of the power of attorney.

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS
§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013.)

.5 Drawings

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User Notes: (1884762936)

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda:

Number	Date	Pages

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[ ] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017.)

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents listed below:
(List here any additional documents that are intended to form part of the Proposed Contract Documents.)

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User Notes: (1884762936)

Additions and Deletions Report for

AIA® Document A701™ – 2018

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 13:51:45 ET on 05/23/2019.

There are no differences.

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User Notes: (1884762936)

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 13:51:45 ET on 05/23/2019 under Order No. 1831144354 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A701™ – 2018, Instructions to Bidders , as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

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User Notes: (1884762936)

STATE OF ALABAMA
BUILDING COMMISSION
770 WASHINGTON AVE
SUITE 444
Montgomery, Alabama 36130-1150
Telephone: (334) 242-4082
Fax: (334) 242-4182

ROBERT BENTLEY
Governor

Katherine Lynn
Director

October 28, 2013

TO: **STATE AGENCIES, K-12 SUPERINTENDENTS, COMMUNITY COLLEGES, UNIVERSITIES**

FROM: **KATHERINE LYNN, DIRECTOR**
ALABAMA BUILDING COMMISSION

SUBJECT: **ACT 2013-205, CERTIFICATE OF EXEMPTION FROM SALES AND USE TAX FOR GOVERNMENTAL ENTITIES**

Act 2013-205 was signed into law on May 9, 2013, granting the Alabama Department of Revenue (ADOR) the authority to issue certificates of exemption from sales and use taxes for construction projects for certain governmental agencies.

Summary

The full text of Act 2013-205 is available on the Building Commission's website at www.bc.alabama.gov. A brief summary of the Act is provided below:

- ADOR shall issue certificates of exemption from sales and use tax to governmental entities for each tax exempt project. Both the governmental entity and the contractor shall apply for certificates of exemption.
- Certificates of exemption shall only be issued for contracts entered into (awarded) on or after Jan. 1, 2014.
- Certificates shall only be issued to contractors licensed by the State Licensing Board for General Contractors or any subcontractor working under the same contract.
- Items eligible for exemption from sales and use tax are building materials, construction materials and supplies and other tangible personal property that become part of the structure per the written construction contract.
- ADOR will handle the administration of certificates of exemption and the accounting of exempt purchases. ADOR will have the ability to levy fines and may bar the issuance or use of certificates of exemption upon determination of willful misuse by the contractor or a subcontractor.
- The contractor shall account for the tax savings on the bid form.

Bidding of Projects Before Jan. 1, 2014

Projects bid before Jan 1, 2014 but awarded on or after Jan. 1, 2014 are still eligible for sales tax exemption regardless of whether the project was bid with or without sales tax. For projects bid before Jan. 1, 2014, the bid documents must specify if the contractor's bid shall or shall not include sales tax.

For projects bid before Jan. 1, 2014, if the project is bid with sales tax and the contractor and subcontractors purchase the materials tax exempt, prior to project closeout the contractor shall submit to the governmental entity a copy of the report filed with the Alabama Department of Revenue showing all exempt purchases. The actual sales tax savings indicated on the report shall be deducted from the final contract amount.

For projects bid after Jan. 1, 2014, the bid shall not include sales tax but the sales tax for the base bid and all bid items must be included on the contractor's bid proposal form. ABC Form C-3A indicates how the sales tax shall be accounted for on the bid proposal form and shall be modified by the project architect or engineer as appropriate for the bid items for each project. **Failure of the contractor to complete the attachment to the bid proposal form indicating the sales tax as required by Act 2013-205, Section 1 (g) shall render the bid non-responsive.**

Proposed Changes to Administrative Rules

Pursuant to Act 2013-205, the ADOR has proposed changes to the following administrative rules:

Rule 810-6-1-.46	Contractor's Liability
Rule 810-6-1-.46.01	Bleacher Systems, Lockers, Backstops, and Other Fixtures Installed in Gymnasiums
Rule 810-6-3-.77	Exemption for Certain Purchases by Contractors and Subcontractors in Conjunction with Construction Contracts with Certain Governmental Entities

A link to the proposed rules and information about the public hearings can be found on ADOR's website at http://www.revenue.alabama.gov/analysis/upcoming-rule-hearings.cfm . All interested parties may present their views in writing to the **Secretary of the Alabama Department of Revenue, Room 4131, Gordon Persons Building, 50 N Ripley Street, Montgomery, Alabama 36132** at any time during the thirty-five (35) day period following publication of the notice or by appearing at the hearing.

If you have any questions, please feel free to contact Katherine Lynn at the Alabama Building Commission at (334) 242-4082 or the Alabama Department of Revenue at (334) 242-1170.

cc: Ms. Julie Magee, Commissioner, Alabama Department of Revenue
Mr. Ben Albritton, Assistant Attorney General

PROPOSAL FORM

To: HOUSTON COUNTY PUBLIC BUILDING AUTHORITY **Date:**_____
(Awarding Authority)

In compliance with your Advertisement for Bids and subject to all the conditions thereof, the undersigned,

_____

(Legal Name of Bidder)

hereby proposes to furnish all labor and materials and perform all work required for the construction of **WORK:** HOUSTON COUNTY DEPARTMENT OF HUMAN RESOURCES, Dothan, Alabama, for HOUSTON PUBLIC BUILDING AUTHORITY in accordance with Drawings and Specifications, dated November 14, 2025, prepared by GOODWYN MILLS CAWOOD, LLC. (Architect's Project No. ABHM250019__), Architect/Engineer.

The Bidder, which is organized and existing under the laws of the State of _____,

having its principal offices in the City of _____,

is: ☐ a Corporation ☐ a Partnership ☐ an Individual ☐ (other) _____.

LISTING OF PARTNERS OR OFFICERS: If Bidder is a Partnership, list all partners and their addresses; if Bidder is a Corporation, list the names, titles, and business addresses of its officers:

_____

_____

_____

_____

_____

BIDDER'S REPRESENTATION: The Bidder declares that it has examined the site of the Work, having become fully informed regarding all pertinent conditions, and that it has examined the Drawings and Specifications (including all Addenda received) for the Work and the other Bid and Contract Documents relative thereto, and that it has satisfied itself relative to the Work to be performed.

ADDENDA: The Bidder acknowledges receipt of Addenda No's. _____ through _____ inclusively.

BASE BID: For construction complete as shown and specified, the sum of:

_____ Dollars ($_____)

ALTERNATES: **NONE**

ALLOWANCES: Refer to Section 01 2100 – "Allowances", and Drawings for descriptions and requirements.
(Allowance Calculations DUE along with Proposal Form on Bid Date.)

COMPLETION DATE: All Base Bid and any Alternate Work in the Contract shall be "Substantially Complete" within 480 consecutive days, from the date of the Owner's written "Notice To Proceed".

UNIT PRICES: Refer to "Attachment A to Proposal Form"
(Attachment A to Proposal Form DUE along with Proposal Form on Bid Date).

MAJOR SUBCONTRACTOR & SUPPLIER LISTING: Refer to "Attachment B to Proposal Form"
(DUE along with Proposal Form on Bid Date, or at Contractor's option, turned in to the Owner within 24-hours after receipt of Bids, with a copy to the Architect).

NOTE THAT ALL SUBCONTRACTORS AND SUPPLIERS ARE SUBJECT TO APPROVAL BY THE OWNER.

ACCOUNTING OF SALES TAX: Refer to "Attachment C to Proposal Form".
(DUE along with Proposal Form on Bid Date).

CHANGES IN WORK: Changes in the Work shall be addressed as described in General Conditions Article on Changes in the Work (and as modified by Supplementary Conditions).

IMMIGRATION STATUS VERIFICATION: Refer to "General Conditions" portion of the Project Manual.
(DUE along with Proposal Form on Bid Date.)

1. Executed E-VERIFY "Memorandum of Understanding".

BID SECURITY: The undersigned agrees to enter into a Construction Contract and furnish the prescribed Performance and Payment Bonds and evidence of insurance within fifteen calendar days, or such other period stated in the Bid Documents, after the contract forms have been presented for signature, provided such presentation is made within 60 calendar days after the opening of bids, or such other period stated in the Bid Documents. As security for this condition, the undersigned further agrees that the funds represented by the Bid Bond (or cashier's check) attached hereto may be called and paid into the account of the Awarding Authority as liquidated damages for failure to so comply.

Attached hereto is a: *(Mark the appropriate box and provide the applicable information.)*

☐ Bid Bond, executed by _____ as Surety,

☐ a cashier's check on the _____ Bank of _____,

for the sum of _____ Dollars

($_____) made payable to the Awarding Authority.

BIDDER'S ALABAMA LICENSE:

State License for General Contracting: _____
License Number Contractor's DUNS No. Bid Limit

_____
Type(s) of Work

CERTIFICATIONS: The undersigned certifies that he or she is authorized to execute contracts on behalf of the Bidder as legally named, that this proposal is submitted in good faith without fraud or collusion with any other bidder, that the information indicated in this document is true and complete, and that the bid is made in full accord with State law. Notice of acceptance may be sent to the undersigned at the address set forth below.

The Bidder also declares that a list of all proposed major subcontractors and suppliers is included and attached to the Proposal Form, or will be turned in to the Owner within twenty-four (24) hours after receipt of bids, with a copy to the Architect.

Bidder certifies that vendors, subcontractors and affiliates, that make sales for delivery into Alabama or leases for use in Alabama are registered, collecting, and remitting Alabama state and local sales, use, and /or lease tax on all taxable sales and leases into Alabama. By submitting a proposal, contractor is hereby certifying that he and his company are in full compliance with Act No. 2006-557, and not barred from bidding or entering into a contract pursuant to 41-4-116 (Code of Alabama 1975), and acknowledge that the awarding authority may declare the contract void if the certification is false.

Legal Name of Bidder _____

Mailing Address _____

*** By (Legal Signature)** _____

* Name (type or print) _____ *(Seal)*

* Title _____

Telephone Number _____

* If other than the individual proprietor, or an above named member of the Partnership, or the above named president, vice-president, or secretary of the Corporation, attach written authority to bind the Bidder. Any modification to a bid shall be over the initials of the person signing the bid, or of an authorized representative.

END OF PROPOSAL FORM

_____

CONTRACTOR

ATTACHMENT A

TO PROPOSAL FORM

1.1 UNIT PRICES:

A. The undersigned proposes the following Unit Prices for additions to or deductions from the Work wherein Unit Prices are applicable as determined by the Architect and Owner. These Unit Prices include all charges for labor and materials, fee, layout, supervision (field and home office), general expenses, taxes, insurance, overhead and profit, for Unit Item of Work in place. The Contract sum shall be increased or decreased based upon quantity difference multiplied by the applicable Unit Price, in accordance with the General Conditions.

B. Refer to Section 01 2200 - "Unit Prices", and to the respective sections of the Specifications for the complete Unit Price Item description.

C. Submit the following Unit Prices with the Proposal Form on Bid Date.

	ITEM DESCRIPTION:	UNIT:*	UNIT PRICE:
1.	Sod	SY	$ _____
2.	Concrete Mud Footings	CY	$ _____
3.	Undercut in Building Control Areas	CY	$ _____
4.	Undercut in Non-Building Control Areas	CY	$ _____
5.	Concrete Sidewalk	SF	$ _____
6.	Chain Link Fence	LF	$ _____
7.	Gypsum Board Ceiling	SF	$_____
8.	Building Canopy	SF	$_____
9.	Walkway Canopy	SF	$_____
10.	Luxury Vinyl Tile (LVT)	SF	$_____
11.	ACT-1 Ceiling Tile and Grid	SF	$_____
12.	ACT02 Ceiling Tile and Grid	SF	$_____
13.	Stamped Concrete	SF	$_____

14.	57 Stone	TN	$_____
15.	Access Control	EA	$_____
16.	Panic Device	EA	$_____
17.	Geotextile Fabric	SY	$_____
18.	Dense Grade Base	TN	$_____

(*) Legend to "unit" quantity abbreviations:

CY	Per "Cubic Yard"
SY	Per "Square Yard"
TN	Per "Ton"
SF	Per "Square Foot"
LF	Per "Linear Foot"

END OF ATTACHMENT A TO PROPOSAL FORM

_____
CONTRACTOR

ATTACHMENT "B"

TO PROPOSAL FORM

1.1 SUBCONTRACTORS LISTING:

A. Submit the following Subcontractors names with the Proposal Form by 2:00 PM local time on Bid Date, OR at Contractor's option, turned in to the Owner within 24-hours after the time scheduled for the opening of Bids, with a copy to the Architect:

SPECIFICATION SECTION:	PRINCIPAL SUBCONTRACTOR OR SUPPLIER - NAME and LOCATION:
SECTION 02 4100 - "DEMOLITION":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 03 3100 - "CONCRETE":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 03 3931 - "CURING, SEALING AND HARDENING CONCRETE FLOORS":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 03 4500 - "ARCHITECTURAL PRECAST CONCRETE":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 04 2000 - "UNIT MASONRY":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 04 7200 - "CAST STONE MASONRY":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

SECTION 05 1200 - “STRUCTURAL STEEL”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 05 3100 - “STEEL DECK”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 05 4000 – “COLD-FORMED METAL FRAMING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 05 4500 - “LIGHT GAUGE STEEL TRUSSES”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 05 5000 - “METAL FABRICATIONS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 05 5100 - “METAL STAIRS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 05 5213 - “PIPE AND TUBE RAILINGS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 06 1000 - “ROUGH CARPENTRY”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 06 2000 – "FINISH CARPENTRY":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

SECTION 06 4000 - "ARCHITECTURAL WOODWORK":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 1113 - "BITUMINOUS DAMPPROOFING":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 1300 - "SHEET WATERPROOFING":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 1400 - "FLUID-APPLIED AIR BARRIER":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 2100 - "THERMAL INSULATION":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 2216 - "ROOF BOARD INSULATION (VENTILATED NAIL BASE)":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 3113 - "ASPHALT SHINGLES":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 4244 - "FIBER CEMENT PANELS":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 6200 - "SHEET METAL FLASHING & TRIM":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

SECTION 07 7100 - “ROOF SPECIALTIES”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 7123 - “MANUFACTURED GUTTERS & DOWNSPOUTS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 8400 - “FIRESTOPPING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 9005 - “JOINT SEALERS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 08 1113 - “STEEL DOORS AND FRAMES”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 08 1416 - “FLUSH WOOD DOORS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 08 3100 - “ACCESS DOORS & PANELS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 08 4313 - “ALUMINUM-FRAMED STOREFRONTS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 08 5413 - “FIBERGLASS WINDOWS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

SECTION 08 7100 - “FINISH HARDWARE”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 08 8000 - “GLAZING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 09 2116 - “GYPSUM BOARD ASSEMBLIES”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 09 3000 - “TILING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 09 5100 - “SUSPENDED ACOUSTICAL CEILINGS”	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 09 6500 - “RESILIENT FLOORING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 09 6813 - “TILE CARPETING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 09 7200 - “WALL COVERINGS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 09 9100 - “PAINTING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

SECTION 10 1100 - “VISUAL DISPLAY UNITS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 10 1400 - “SIGNAGE”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 10 2113.18 - “PHENOLIC TOILET COMPARTMENTS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 10 2601 - “WALL AND CORNER GUARDS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 10 2800 - “TOILET AND BATH ACCESSORIES”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 10 4400 - “FIRE PROTECTION SPECIALTIES”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 10 5613 - “METAL STORAGE SHELVING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 10 5623 - “WIRE STORAGE SHELVING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 10 7316 - “CANOPIES”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

SECTION 10 7500 - “FLAGPOLES”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 11 3100 - “KITCHEN AND LAUNDRY EQUIPMENT”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 12 2113 - “HORIZONTAL LOUVER BLINDS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 12 3540 - “LAMINATE CASEWORK”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 12 4813 - “ENTRANCE MATS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 14 2010 - “PASSENGER ELEVATORS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
DIVISION 21 - FIRE SUPPRESSION:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
DIVISION 22 - PLUMBING SUBCONTRACTOR:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
DIVISION 23 - MECHANICAL SUBCONTRACTOR:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

DIVISION 26 - ELECTRICAL SUBCONTRACTOR:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
DIVISION 27 – COMMUNICATIONS:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
DIVISION 28 – ELECTRONIC SAFETY AND SECURITY:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 31 1000 - “SITE CLEARING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 31 2000 - “EARTH MOVING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 31 2500 - “EROSION AND SEDIMENTATION CONTROLS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 31 3116 - “TERMITE CONTROL”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 32 1216 - “ASPHALT PAVING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 32 1313 - “CONCRETE PAVING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

SECTION 32 1613.13 - "CAST-IN-PLACE CONCRETE CURBS AND GUTTERS":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 32 1623 - "SIDEWALKS":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 32 1723 - "PAVEMENT MARKINGS":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 32 3113 - "CHAIN LINK FENCES AND GATES":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 32 3300 - "SITE FURNISHINGS":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 32 8400 - "PLANTING IRRIGATION":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 32 9200 - "TURF AND GRASSES:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
PLANTS:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 33 3000 – "SANITARY SEWERAGE UTILITIES":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

SECTION 33 4000 – "STORM DRAINAGE UTILITIES":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 33 4613 – "FOUNDATION DRAINAGE":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
OTHER:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
OTHER:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
OTHER:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
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OTHER:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
OTHER:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
OTHER:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
OTHER:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

This list is not necessarily all inclusive. Submit all primary subcontractors whether their trade is listed here or not.

END OF ATTACHMENT "B" TO PROPOSAL FORM

ACCOUNTING OF SALES TAX
Attachment to
Proposal Form

To: _____ Date: _____
(Awarding Authority)

NAME OF PROJECT _____

_____

SALES TAX ACCOUNTING

Pursuant to Act 2013-205, Section 1(g) the Contractor accounts for the sales tax NOT included in the bid proposal form as follows:

ESTIMATED SALES TAX AMOUNT

BASE BID: …….$ _____

Alternate No. 1 (……..……..) (add)(deduct) $ _____
(Insert key word for Alternate)
Alternate No. 2 (……..……..) (add)(deduct) $ _____
Alternate No. 3 (……..……..) (add)(deduct) $ _____
Alternate No. 4 (……..……..) (add)(deduct) $ _____
Alternate No. 5 (……..…..) (add)(deduct) $ _____
Alternate No. 6 (……..…..) (add)(deduct) $ _____
Alternate No. 7 (……..……..) (add)(deduct) $ _____
Alternate No. 8 (……..……..) (add)(deduct) $ _____
Alternate No. 9 (……....) (add)(deduct) $ _____
Alternate No. 10 (……..) (add)(deduct) $ _____
Alternate No. 11 (……..) (add)(deduct) $ _____
Alternate No. 12 (……..) (add)(deduct) $ _____

Failure to provide an accounting of sales tax shall render the bid non-responsive. Other than determining responsiveness, sales tax accounting shall not affect the bid pricing nor be considered in the determination of the lowest responsible and responsive bidder.

Legal Name of Bidder _____

Mailing Address _____

* **By (Legal Signature)** _____

* Name (type or print) _____ *(Seal)*

* Title _____

Telephone Number _____

IMMIGRATION STATUS VERIFICATION

1.1 GENERAL:

A. Bidders are hereby reminded that they are required to comply with requirements of Alabama Immigration Law, Act 2011-535 (also referred to as the "Beason-Hammon Alabama Taxpayer and Citizen Protection Act", or H.B. 56). This Law was amended by Act No. 2012-491 and signed into law by the Governor May 18, 2012. The following requirements are in effect:

1. Contractors are required to enroll in the E-Verify program of the United States Department of Homeland Security and to provide documentation of enrollment in the E-Verify program with their contracts and agreements. E-Verify MOU shall be submitted with Proposal Form.

2. Statement of Compliance with Act No. 2012-491 shall be attached to Construction Contract, and shall include the following statement:

> ***By signing this contract, the contracting parties affirm, for the duration of the agreement, that they will not violate federal immigration law or knowingly employ, hire for employment, or continue to employ an unauthorized alien within the State of Alabama. Furthermore, a contracting party found to be in violation of this provision shall be deemed in breach of the agreement and shall be responsible for all damages resulting therefrom.***

B. Additional information and Guidance is available at the following websites:

1. E-Verify portal maintained by State of Alabama: http://immigration.alabama.gov

2. Alabama Department of Finance, Comptroller's Website - Compliance Guidelines: http://comptroller.alabama.gov/pdfs/Memos/2012-01-06%20Alabama%20Immigration%20Law.pdf

3. Alabama Secretary of State's Website: Including in part, rules and acceptable form for affidavits for business entities, employers, contractors, and subcontractors. http://www.sos.state.al.us/

4. Alabama Building Commission: http://www.bc.state.al.us/Memo%20on%20Act%202011-535-Alabama%20Immigration%20Law-1-11-2012.pdf

5. US Department of Homeland Security, E-Verify: www.dhs.gov/E-Verify

JULIE P. MAGEE
Commissioner

State of Alabama
Department of Revenue
(www.revenue.alabama.gov)
50 North Ripley Street
Montgomery, Alabama 36132

MICHAEL E. MASON
Assistant Commissioner
JOE W. GARRETT, JR.
Deputy Commissioner
CURTIS E. STEWART
Deputy Commissioner

Alabama Department of Revenue
NOTICE

Tax Guidance for Contractors, Subcontractors and Alabama Governmental Entities Regarding Construction-related Contracts

Legislative Act 2013-205 requires the Department of Revenue to issue Form STC-1, *Sales and Use Tax Certificate of Exemption for Government Entity Projects,* to all contractors and subcontractors working on qualifying governmental entity projects once the Form ST: EXC-01 is approved.

Each exempt entity, contractor and subcontractor must make application for qualification of the exemption using Form ST: EXC-01 for each tax-exempt project. The application is available on the department's website at http://revenue.alabama.gov/salestax/ST-EXC-01.pdf. Applications should be submitted directly to the Sales and Use Tax Division Central Office, P.O Box 327710, Montgomery, AL 36132-7710.

The sales and use tax exemption provided for in Act 2013-205 applies to the purchase of building materials, construction materials and supplies, and other tangible personal property that become part of the structure pursuant to a qualifying contract entered into on or after January 1, 2014. Qualifying projects and contracts are those generally entered into with the following governmental entities, unless otherwise noted: the State of Alabama, a county or incorporated municipality of Alabama, an Alabama public school, or an Alabama industrial or economic development board or authority already exempt from sales and use taxes. **Please note that contracts entered into with the federal government and contracts pertaining to highway, road, or bridge construction or repair do not qualify for the exemption provided for in Act 2013-205.** [Reference: Sales and Use Tax Division Administrative Rule 810-6-3-.77 *Exemption for Certain Purchases by Contractors and Subcontractors in Conjunction with Construction Contracts with Certain Governmental Entities.*]

The Alabama Department of Revenue will assign each contractor and sub-contractor a consumers use tax account, if one is currently not in place, at the time the Form STC-1, Sales *and Use Tax Certificate of Exemption for Government Entity Projects*, is issued.

Contractors and sub-contractors for qualifying projects will be required to file monthly consumers use tax returns and report all exempt purchases for ongoing projects, as well as all taxable purchases on one return. These returns are required to be filed through the department's online tax return filing and payment portal, My Alabama Taxes (https://myalabamataxes.alabama.gov).

As another option for these types of contracts, as well as with other contracts entered into with other types of exempt entities, the Form ST:PAA1, *Purchasing Agent Appointment*, may be used. However, please be advised that the use of the Form ST:PAA1 option will require the exempt entity to be invoiced directly and pay for directly from their funds any construction and building material and supply purchases.

For additional information concerning this guidance, taxpayers should contact Sales and Use Tax Division representative Thomas Sims at 334-242-1574 or by email at Thomas.Sims@revenue.alabama.gov.

ST: EXC-01
1/14

ALABAMA DEPARTMENT OF REVENUE
SALES AND USE TAX DIVISION
P.O Box 327710 • Montgomery, AL 36132-7710

Application For Sales and Use Tax Certificate of Exemption

FOR GOVERNMENT ENTITY PROJECT

This Certificate of Exemption will be limited to purchases which qualify for an exemption of sales and use taxes pursuant to Rule No. 810-6-3-.77

PROJECT INFORMATION:

PROJECT NAME				PROJECT OWNER'S FEIN (EXEMPT ENTITY)
STREET ADDRESS OF PROJECT (CITY AND COUNTY INCLUDED)	**CITY**	**ZIP**	**COUNTY**	

APPLICANT'S INFORMATION:

RELATION: *(CHOOSE ONE)*			NAICS CODE
☐ Exempt Entity ☐ General Contractor ☐ Sub-Contractor			
APPLICANT'S LEGAL NAME			FEIN
DBA			CONSUMER'S USE TAX ACCOUNT NUMBER

MAILING ADDRESS

CONTACT PERSON	BUSINESS TELEPHONE NUMBER
	( )

ESTIMATED START DATE	ESTIMATED COMPLETION DATE

REASON EXEMPTION IS CLAIMED

JOB DESCRIPTION

WILL ANY POLLUTION CONTROL EXEMPTION BE APPLICABLE?	ESTIMATED POLLUTION CONTROL COST
☐ Yes ☐ No	$

TOTAL BID AMOUNT	LABOR COST	MATERIAL COST
$	$	$

PROJECT NAME	PROJECT OWNER'S FEIN (EXEMPT ENTITY)

FORM OF OWNERSHIP:

☐ Individual ☐ Partnership ☐ Corporation ☐ Multi member LLC ☐ Single member LLC

If applicant is a corporation, a copy of the certified certificate of incorporation, amended certificate of incorporation, certificate of authority, or articles of incorporation should be attached. If the applicant is a limited liability company or a limited liability partnership, a copy of the certified articles of organization should be attached.

OWNERSHIP INFORMATION:

Corporations – give name, title, home address, and Social Security Number of each officer.

Partnerships – give name, home address, Social Security Number or FEIN of each partner.

Sole Proprietorships – give name, home address, Social Security Number of owner.

LLC – give name, home address, and Social Security Number or FEIN of each member.

LLP – give name, home address, and Social Security Number or FEIN of each partner.

NAME *(PLEASE PRINT)* SIGNATURE

TITLE DATE

Exempt entity must provide a copy of the contract accepted by the General Contractor. The General Contractor must provide a copy of the contract and a list of sub-contractors to the Department of Revenue, Sales and Use Tax Division. Any updates, additions and/or deletions, must also be submitted to the Department within 30 days of occurrence.

REVENUE DEPARTMENT USE ONLY

Examiner's Remarks _____

Examiner _____ Date _____

Supervisor's Recommendation _____

Supervisor _____ Date _____

BID BOND FORM

1.1 Bid Bond shall be executed equivalent to AIA Document A310, Bid Bond. A draft copy is attached for reference. Copies of A310 are available for viewing in the office of the Architect, and may be purchased from an AIA documents vendor by the Contractor.

END OF BID BOND FORM

AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

BOND AMOUNT: $

PROJECT:
(Name, location or address, and Project number, if any)

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a

ADDITIONS AND DELETIONS:
The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

DRAFT

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common law bond.

Signed and sealed this day of ,

(Contractor as Principal)	*(Seal)*
(Witness)	*(Title)*
(Surety)	*(Seal)*
(Witness)	*(Title)*

DRAFT

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CONSTRUCTION CONTRACT FORM

1.1 The Construction Agreement shall be executed on A.I.A. Document A101 - 2017 Edition, a copy of which is attached for reference. Copies are available for viewing in the office of the Architect, and may be purchased from an A.I.A. documents vendor by the Contractor.

END OF CONSTRUCTION CONTRACT FORM

AIA® Document A101® – 2017

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the day of in the year
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

and the Contractor:
(Name, legal status, address and other information)

for the following Project:
(Name, location and detailed description)

The Architect:
(Name, legal status, address and other information)

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:
The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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TABLE OF ARTICLES

1 THE CONTRACT DOCUMENTS

2 THE WORK OF THIS CONTRACT

3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

4 CONTRACT SUM

5 PAYMENTS

6 DISPUTE RESOLUTION

7 TERMINATION OR SUSPENSION

8 MISCELLANEOUS PROVISIONS

9 ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[ ] The date of this Agreement.

[ ] A date set forth in a notice to proceed issued by the Owner.

[ ] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve

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Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

[ ] Not later than ( ) calendar days from the date of commencement of the Work.

[ ] By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

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ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than ( ) days after the Architect receives the Application for Payment. *(Federal, state or local laws may require payment within a certain period of time.)*

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

- **.1** That portion of the Contract Sum properly allocable to completed Work;
- **.2** That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- **.3** That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

- **.1** The aggregate of any amounts previously paid by the Owner;
- **.2** The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
- **.3** Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- **.4** For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
- **.5** Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

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(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

%

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.

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(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[ ] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[ ] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

§ 8.3 The Contractor's representative:

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(Name, address, email address, and other information)

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with a building information modeling exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with a building information modeling exhibit, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction

.4 Building information modeling exhibit, dated as indicated below:
(Insert the date of the building information modeling exhibit incorporated into this Agreement.)

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

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Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[ ] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
(Printed name and title)	*(Printed name and title)*

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PERFORMANCE BOND AND PAYMENT BOND FORM

1.1 Performance and Payment Bond shall be provided for 100% of the Contract amount, and shall be executed on AIA Document A312, latest edition. A draft of AIA Document A312 – 2010 is attached. Copies of document are available for viewing in the office of the Architect, and can be purchased from an AIA documents vendor by the Contractor and/or their surety.

END OF PERFORMANCE BOND AND PAYMENT BOND FORM

AIA® Document A312® – 2010

Performance Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:
Amount: $
Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)
Amount: $
Modifications to this Bond:

(Any additional signatures appear on the last page of this Performance Bond.)

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*
Signature: _____
Name and Title:

SURETY
Company: *(Corporate Seal)*
Signature: _____
Name and Title:

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

ADDITIONS AND DELETIONS:
The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors ef assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

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.2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

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(Any additional signatures appear on the last page of this Performance Bond)

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

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AIA® Document A312® – 2010

Payment Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:
Amount: $
Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)
Amount: $
Modifications to this Bond:

(Any additional signatures appear on the last page of this Payment Bond.)

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*

Signature: _____
Name and Title:

SURETY
Company: *(Corporate Seal)*

Signature: _____
Name and Title:

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

ADDITIONS AND DELETIONS:
The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

- **.1** have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
- **.2** have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

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§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- **.1** the name of the Claimant;
- **.2** the name of the person for whom the labor was done, or materials or equipment furnished;
- **.3** a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- **.4** a brief description of the labor, materials or equipment furnished;
- **.5** the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- **.6** the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- **.7** the total amount of previous payments received by the Claimant; and
- **.8** the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under

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the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

(Any additional signatures appear on the last page of this Payment Bond)

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

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GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

1.1 The "General Conditions of the Contract for Construction," A.I.A. Document A201, 2017 Edition, (also referred to as "General Conditions", "Conditions of the Contract", etc.), Articles 1 through 15, inclusive, is a part of this contract, and is incorporated herein as fully as if here set forth.

1.2 Copies of A.I.A. Document A201 are available for viewing in the office of the Architect, and can be purchased from an A.I.A. documents vendor by the Contractor.

1.3 See "Supplementary Conditions" and "Special Conditions" for supplements which modify, change, delete, and/or add to the General Conditions.

1.4 A draft copy of A201 – 2017 is attached for reference.

END OF GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

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4 ARCHITECT

5 SUBCONTRACTORS

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7 CHANGES IN THE WORK

8 TIME

9 PAYMENTS AND COMPLETION

10 PROTECTION OF PERSONS AND PROPERTY

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For guidance in modifying this document to include supplementary conditions, see AIA Document A503™–2017, Guide for Supplementary Conditions.

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14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 CLAIMS AND DISPUTES

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

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§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon written protocols governing the transmission and use of, and reliance on, Instruments of Service or any other information or documentation in digital form.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to written protocols governing the use of, and reliance on, the information contained in the model shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model,

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and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

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§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of

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facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be

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of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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.1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

.2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

.3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

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§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such

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services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

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§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

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§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract,

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shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- **.1** assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- **.2** assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The

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Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

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§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- **.1** The change in the Work;
- **.2** The amount of the adjustment, if any, in the Contract Sum; and
- **.3** The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- **.1** Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- **.2** Unit prices stated in the Contract Documents or subsequently agreed upon;
- **.3** Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- **.4** As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- **.1** Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- **.2** Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- **.3** Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- **.4** Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- **.5** Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the

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Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

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§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later

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than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- **.5** damage to the Owner or a Separate Contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- **.7** repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint

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checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is

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sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

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§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

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§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

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§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage,

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the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the

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damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor

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to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

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§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- **.3** Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- **.4** The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.1** repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- **.2** fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- **.3** repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- **.4** otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

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.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

.1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not

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more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- **.1** damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- **.2** damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition

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precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

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§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

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SUPPLEMENTARY CONDITIONS

1.1 GENERAL CONDITIONS:

A. The "General Conditions of the Contract for Construction", AIA Document A201, 2017 Edition, Articles 1 through 15, inclusive, (General Conditions or Conditions of the Contract hereinafter) is a part of this contract, and is incorporated herein as fully as if here set forth.

2.2 SUPPLEMENTS:

A. The following supplements, modify, change, delete or add to the General Conditions. Where any part of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered provisions of that part shall remain in effect.

1. ARTICLE 1 - GENERAL PROVISIONS:

a. Add the following new subparagraph:

"1.5.3 Any written permission given for use of the Drawings, Specifications, and/or other Documents prepared by the Architect and/or the Architect's consultants which is provided under the terms of this Article, shall require and be subject to payment to the Architect for such use, as determined to be equitable by the Architect or as mutually agreed in writing between the Architect and the party or parties requesting and receiving permission for any such use."

b. Add the following new Subparagraphs:

1.6.1 The Architect may, with the concurrence of the Owner, furnish to the Contractor versions of Instruments of Service in electronic form. The Contract Documents executed or identified in accordance with Subparagraph 1.1.1 shall prevail in case of an inconsistency with subsequent versions made through manipulatable and/or non-manipulatable electronic operations involving computers.

1.6.2 The Contractor shall not transfer or reuse Instruments of Service in electronic or machine readable form without the prior written consent of the Architect, and payment to the Architect in amount(s) agreeable to the Architect for such use.

1.6.3 Representatives of the Owner, Contractor, and/or Architect shall meet periodically, if required by the Owner or Architect, at mutually agreed-upon intervals for the purpose of establishing procedures to facilitate cooperation, communication and timely responses among the participants. By participating in this arrangement, the parties do not intend to nor will they create additional contractual obligations or modify the legal relationships which may otherwise exist."

2. ARTICLE 2 - OWNER:

a. Refer to Paragraph 2.2.2, and add the following new Subparagraphs:

2.2.2.1 The Contractor shall secure and pay for all necessary permits, fees, etc., as necessary for the execution and completion of the Work of the project, unless specifically indicated otherwise within the Bid and Contract Documents; Which shall include in part, building permit, inspection fees, utility connection fees, utility impact fees, licenses, and other charges which may be applicable and/or due at the time when bids were received or negotiations concluded.

2.2.2.2 Unless specifically indicated otherwise on the Drawings or in the Project Manual, the Owner will furnish all necessary Environmental and Storm Water permits customarily required for this type of project; The Contractor shall comply with the requirements and directions of the Owner and/or imposed on the Owner for compliance with these requirements.

b. Add the following new paragraph:

"2.2.5 The Contractor will make these documents available in electronic format (PDF) for subcontractors to download."

3. ARTICLE 3 - CONTRACTOR:

a. Refer to Paragraph 3.2, and add the following new Subparagraph:

"3.2.5 The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for the Architect to evaluate and respond to the Contractor's requests for information, where such information was available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination Drawings, or prior Project correspondence and/or documentation."

b. Refer to Paragraph 3.3, and add the following new Subparagraph:

"3.3.4 The Contractor shall lay out their own work. They shall be responsible for all work executed by them under the Contract which shall be constructed to the lines and grades as shown on the Drawings. They shall verify all figures and elevations before proceeding with the work, and will be held responsible for any error resulting from failures to do so."

c. Delete Paragraph 3.4.2, and substitute the following:

"3.4.2 After the Contract has been executed, the Owner and Architect will consider a formal request for the substitution of products in place of those specified, only under the conditions set forth in the General Requirements (Division 1 of Specifications). By making requests for substitutions, the Contractor:

3.4.2.1 represents that the Contractor has personally investigated the proposed substitute product and determined that it is equivalent to or superior in all respects to that specified;

3.4.2.2 represents that the Contractor will provide at least the same warranty for the substitution that the Contractor would for that specified;

3.4.2.3 certifies that the cost data presented is complete and includes all related costs under this Contract, except the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and

3.4.2.4 will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects."

d. Add the following new Subparagraph:

"3.4.4 The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect to evaluate the Contractor's proposed substitutions, regardless of whether or not the proposed substitution is subsequently accepted by the Owner and/or Architect, and to make agreed-upon changes in the Drawings and Specifications made necessary by the Owner's acceptance of such substitutions."

e. Revise the following Subparagraphs:

Before the semicolon at the end of Subparagraph 3.8.2.2, add the following:

", except that if installation is included as part of an allowance in Divisions 1-16 of the Specifications, the installation and labor cost for greater or lesser quantities of Work shall be determined in accordance with Subparagraph 7.3.7, unless specifically indicated otherwise;"

Refer to Subparagraph 3.8.2.2, and add the following after the word "profit":
", temporary storage,"

Refer to Subparagraph 3.8.2.3, and add the following phrase at the end:

", which could not reasonably be anticipated by the Contractor at the time of bidding, and/or which are not due to any cause or delay by the Contractor, and/or which are due to causes over which the Contractor had no control."

f. Refer to Subparagraph 3.9.2, and add the following new Subparagraphs:

"3.9.2.1 Contractor's Superintendent shall be properly qualified and have a minimum of five (5) years experience as superintendent for this Contractor. Contractor shall furnish within five days of their receipt of the Contract, records of proposed Superintendent's education and experience, construction project experience and in what capacities, names of architects for these projects, and

information sufficient to determine suitability for the proposed position for this project.

3.9.2.2 Refer to Division 1 Section "Special Conditions", and individual specifications sections throughout the Project Manual, for additional information and minimum experience requirements."

g. Refer to Subparagraph 3.10.3, and add the following at the end:

"If the project is behind the Construction Schedule, the Contractor shall act on each portion which is not in general accordance with the Construction Schedule, to whatever extent is required to move progress of the Work back into general accordance with the Construction Schedule, at no additional cost to the Owner."

h. Refer to Subparagraph 3.12.7, and change the word "approved" to read "reviewed".

i. Refer to Subparagraphs 3.12.8 and 3.12.9, and revise the following:

Change the word "approved" to read "reviewed", wherever it occurs.

Change the word "approval" to read "review", wherever it occurs.

j. Add the following new Subparagraph:

"3.12.11 The Architect's review of Contractor's submittals will be limited to examination of an initial submittal and ONE (1) resubmittal. The Architect's review of additional submittals will be made only with the consent of the Owner, after notification by the Architect. The Owner shall be entitled to deduct from the Contract Sum, amounts due to the Architect for evaluation of such additional resubmittals."

k. Refer to Subparagraph 3.15.1, and add the following new Subparagraph:
"3.15.1.1 Remove broken or scratched glass and replace with new glass, remove paint droppings, spots, stains, and dirt from finished surfaces and exposed concrete, masonry, stucco, and similar surfaces, and clean plumbing fixtures, hardware, floors, and equipment. Contractor shall keep interior of the building free of stored or unattended combustible material."

4. ARTICLE 4 - ADMINISTRATION OF THE CONTRACT:

a. Refer to Subparagraph 4.2.7, and revise as follows:

In first sentence, after the word "approve", add "and/or make comments," .

In the last two sentences, change the word "approval", to read "review and/or approval".

b. Refer to Subparagraph 4.2.9, and change the word "inspections", to read "construction observations and final inspection(s)".

5. ARTICLE 5 - SUBCONTRACTORS:

a. Refer to Subparagraph 5.2.1, and add the following new Subparagraph:

"5.2.1.1 Submittal of list as required of the Contractor, shall include all major Subcontractors and Suppliers, and shall be submitted not later than, either along with the Contractor's completed Proposal Form, or shall be submitted to the Owner, with copy to Architect, within 24-hours of the time and date that bids are scheduled to be opened. Refer to Division 1 Section "Special Conditions" for additional information and minimum requirements."

6. ARTICLE 7 - CHANGES IN THE WORK:

a. Refer to paragraph 7.2 Change Orders, and add the following new Subparagraph 7.2.2.

"7.2.2 Change Orders for this project shall have a total of 25% maximum mark-up if sub-contractor and general contractor are involved. Sub-contractor shall have 15% mark-up (10% to cover overhead such as insurance, bond, labor, labor burden, etc. and the remaining 5% for profit). Contractor shall have 10% mark-up (5% to cover all overhead as mentioned above under sub-contractor, and 5% for profit). If the general contractor self-performs the work then they shall be allowed 15% mark-up.

Should changes which will decrease the cost of the work be ordered by the Architect, then the Contract Price shall be reduced by an amount equal to the agreed estimated saving resulting from these changes, and further reduced by the Contractor's and Subcontractor's, if applicable, overhead and profit.

7. ARTICLE 8 - TIME:

a. Refer to Subparagraph 8.1.2, and add the following new Subparagraph:

"8.1.2.1 The date of commencement shall be established as the earlier of either the date the Contractor receives the fully executed Contract, or the date indicated on the Owner's written "Notice To Proceed", unless mutually agreed otherwise and in writing between the Owner and the Contractor."

b. Refer to Subparagraph 8.2.2, and revise as follows:

At end of first sentence, omit the words "and Owner".

8. ARTICLE 9 - PAYMENTS AND COMPLETION:

a. Refer to Subparagraph 9.2, and change the word "Architect", to read "Architect and/or Owner", wherever it occurs.

b. Refer to Subparagraph 9.3.1, and add the following sentence and new Subparagraphs:

"The form of Application of Payment, duly notarized, shall be a current authorized edition of AIA Document G702, or approved equivalent document, supported by a current authorized edition of AIA Document G703 or approved equivalent continuation sheet.

9.3.1.3 Until the Work is **100-percent complete**, the Owner shall pay **95-percent of the first 50-percent** of the amount due the Contractor on account of progress payments, **and no additional retainage thereafter,** except as otherwise provided. Unless for reasons otherwise provided in the Contract Documents, thereafter, there will be no further retainage withheld.

9.3.1.4 Upon completing all requirements to achieve Substantial Completion, as defined within the Contract Documents, the payment shall be sufficient to increase the total payments to **98-percent of the contract sum**, less such amounts as the Architect and/or Owner shall determine for all incomplete work and unsettled claims, except as otherwise provided."

c. Refer to Subparagraph 9.7, and revise as follows:

Change the word "seven", to read "ten", wherever it occurs.

Omit the last nine words, beginning with ", plus…" through the word "Documents".
Add the following Sentence: "In the event it is deemed necessary by the Architect and/or Owner to return a request and/or requests for progress payment to the Contractor, the time limits indicated herein for payment shall begin from the date of receipt of a request for progress payment which is subsequently resubmitted, and found acceptable by the Architect and/or Owner."

d. Refer to Subparagraph 9.8.3, and add the following new Subparagraph:

"9.8.3.1 Except with the consent of the Owner, the Architect will perform no more than one (1) inspection and one (1) reinspection to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for any additional inspections and/or re-inspections due to incomplete work and/or unsettled claims."

e. Refer to Subparagraph 9.8.5, delete the second sentence, and substitute the following:

"Upon such acceptance and consent of surety, if any, the Owner shall make payment sufficient to increase the total payments to 98-percent (98%) of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work and unsettled claims."

f. Refer to Subparagraph 9.10.1, and add the following new Subparagraph:

"9.10.1.1 Except with the consent of the Owner, the Architect will perform no more than one (1) inspection and one (1) reinspection to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for any additional inspections and/or re-inspections due to incomplete work, unsettled claims and/or other cause or causes attributable to the responsibilities of the Contractor."

9. ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY:

a. Refer to Subparagraph 10.1, and add the following:

"In performing this work, the Contractor shall in part, take all necessary precautions for ample protection of personnel, property, and equipment from falling debris, dust, or undue exposure to weather. The safety provisions of applicable laws, building and construction codes shall be observed and applicable provisions of the latest edition of the AGC "Manual of Accident Prevention" shall be adhered to and followed. All passageways, guard fences, lights and other facilities required for protection of the public and workmen shall be provided and maintained."

10. ARTICLE 11 - INSURANCE AND BONDS:

a. Delete Paragraphs 11.2, 11.3, and 11.4, and replace with the following:

"11.2 CONTRACTOR'S AND SUBCONTRACTOR'S MINIMUM LIABILITY INSURANCE:

11.2.1 The insurance required by Subparagraph 11.1 shall be written for not less than the following minimum limits of liability, or greater if required by law. **Additionally named primary insureds shall be *"the Owner, Architect, and their Consultants"*, except not on Worker's Compensation; all insurance certificates shall provide for "Waiver of Subrogation" against *"the Owner, Architect, and their Consultants"*, by the Contractor, each Subcontractor, and their insurers.** Refer also to Division 1 Section "Special Conditions", for additional information and requirements.

11.2.2 **MINIMUM COVERAGE(S) REQUIRED:**

11.2.2.1 Workers' Compensation:

a.	State	Statutory
b.	Applicable Federal	Statutory
c.	Employer's Liability	$1,000,000
d.	Benefits Required by Union Labor Requirements	As applicable.
e.	Voluntary Compensation	$1,000,000

f. Broad Form all states Endorsement.

11.2.2.2 Comprehensive General Liability:

a. Including Premises-Operations; Independent Contractors' Protective; Products and Completed Operations; Broad Form Property Damage; Contractual Liability; Personal Injury; all as combined single limits:

1) General Aggregate: $2,000,000, with general aggregate of $2,000,000 applicable to this project only; including in part, Bodily Injury/Property Damage $2,000,000 each occurrence.

2) Products/Completed Operations: $2,000,000 annual aggregate.

Products and Completed Operations Insurance shall be maintained for three (3) years after the work has been completed; property damage liability insurance shall provide X, C, and U coverage; Fellow Employee suits shall be included.

3) Personal and Advertising Injury: $1,000,000 per occurrence.

4) Each Occurrence: $1,000,000.

11.2.2.3 Comprehensive Commercial Business Automobile Liability (owned, non-owned, hired):

a. Combined single limits for bodily injury and property damage:

1) Bodily Injury/Property Damage $1,000,000 each occurrence.

11.2.2.4 Aircraft Liability (owned and non-owned) when applicable:

a. Furnish proof of coverage with the following limits (combined single limits for bodily injury and property damage):

1) Admitted liability $1,000,000 per seat.

2) Bodily Injury/Property damage $1,000,000 each occurrence.

11.2.2.5 Commercial Umbrella Excess Liability over Primary Insurance:

a. $4,000,000 each occurrence.
b. Products/Completed Operations: $4,000,000 aggregate.

c. General Aggregate: $4,000,000.

11.2.2.6 Indemnity:

a. The Contractor shall assume all liability for and shall indemnify and save harmless the Owners, Architect, and their consultants and employees from: All damages and liability for injury to any person or persons, and injury to or destruction of property, including the loss of use thereof, by reason of an accident or occurrence arising from operations under the Contract, whether such operations be by himself, or by any subcontractor or by anyone directly or indirectly employed by either of them, occurring on or about the premises or the ways and means immediately adjacent, during the term of the contract, or any extension thereof, and shall also assume the liability for injury and/or damages to adjacent or neighboring property by reason of work done under this Contract; The obligations of the work done under this Contract. The obligations of the contractor under this paragraph shall not extend to the liability of the Architect, his agents or employees arising out of:

1) The preparation or approval of maps, drawings, opinions, reports, surveys, Change Orders, design or specifications, or;

2) The giving or the failure to give directions or instructions by the Architect, his agents or employees, upon request, provided such giving of or failure to give is the primary cause of the injury or damage.

The insurance shall extend to and include all of the contractor's operations, regardless of whether they may be in connection with work that is temporary, permanent, included in any of the bid items or classified as extra work.

A statement of the above indemnity coverage and condition shall be included on the Insurance Certificate or Policy.

11.2.2.7 Certificates of Insurance acceptable to the Owner shall be filed with the Owner prior to signing of the Contract for the Work of this project, and along with the required 100% Performance and 100% Payment Bonds (100% of Contract amount), shall be attached to the Contract(s). These certificates shall contain a provision that policy coverage will not be changed or canceled until at least thirty (30) days prior written notice has been given the Owner and Architect, which may be reduced to at least ten (10) days for non-payment of premium only.

a. Provide copies of policies renewed, altered and/or replaced during the Work of this project, to the Owner within 10-days of their effective date(s), with copy sent to the Architect.

11.3 PROPERTY INSURANCE:

11.3.1 The Contractor shall provide an All Risk ("open perils") Builder's Risk Policy with a replacement cost valuation, to cover the interests of all contractor's and sub-contractors of any tier. The contractor and subcontractors of any tier shall be responsible for all risks of physical loss to the work not otherwise covered, including in part, portions of the work stored off the site and in transit between off site storage and site.

11.3.2 The total amount of the insurance shall be the amount of the contract.

11.3.3 The policy or policies shall be endorsed to waive all rights of subrogation among, between, and to each insured under the policy.

11.3.4 The "Owner, Architect, and their Consultants" shall be additionally named primary insureds under the policy or policies. Refer also to Division 1 Section "Special Conditions", for additional information and requirements.

11.3.5 Any deductibles will be apportioned to the named insureds (but excluding those named in 11.3.4) as their interests may appear, based upon claim payments.

11.3.6 Any claims coming under the terms and conditions of the policies shall be immediately reported by written notice to the Architect, with a copy to the Owner:

Goodwyn, Mills & Cawood, Inc.
2701 First Avenue South, Suite 100
Birmingham, Alabama 35233
Phone: (205) 879-4462

11.4 PERFORMANCE AND PAYMENT BOND:

11.4.1 The Contractor and subcontractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder. Bonds may be obtained through the Contractor's usual source, and the cost thereof shall be included in the Bid and Contract Sum. The amount of each bond shall be equal to 100-percent (100%) of the Contract Sum.

11.4.1.1 The Contractor shall deliver the required bonds to the construction manager attached to each copy of the Contract which the Contractor is presented to execute for the Work of the Project.

11.4.1.2 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the Power of Attorney."

11. ARTICLE 12 - UNCOVERING AND CORRECTION OF WORK:

a. Refer to Subparagraph 12.2.2, and add the following new Subparagraphs:

"12.2.2.1.1 For the purposes of this paragraph, "reasonable time" shall be defined as within ten (10) consecutive calendar days from and after receipt of notice from the Owner and/or Architect."

"12.2.2.4 Upon request by the Owner, and prior to the expiration of the expiration of one year from the date of Substantial Completion, the Architect will conduct and the Contractor shall attend a meeting with the Owner to review the facility operations and performance."

12. ARTICLE 15 - CLAIMS AND DISPUTES

a. Refer to Subparagraph 15.1.5, and add the following new Subparagraphs:

"15.1.5.1 Claims for increase in the Contract Time shall set forth in detail circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work, and the number of normal working days' increase in the Contract Time claimed as a consequence of each such cause of delay. The Contractor shall provide such supporting documentation as the Owner may require, including where appropriate, a revised construction schedule indicating all the activities affected by the circumstances forming the basis of the Claim.

15.1.5.2 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor.

15.1.5.3 Refer to Division 1 Section "Special Conditions" and other applicable portions of the Bid and Contract Documents for additional information, requirements, reporting requirements, limitations and exclusions relating to claims for additional time."

END OF SUPPLEMENTARY CONDITIONS

Goodwyn Mills Cawood

2400 5th Avenue South
Suite 200
Birmingham, AL 35233

T (205) 879-4462

www.gmcnetwork.com

Special Provisions of the Contract Documents:
Add the following:

Under no circumstance will GMC provide hard copy sets of drawings, project manuals, or other contract documents. Upon request from bidders, GMC will provide electronic (PDF) sets of drawings and project manuals prior to award of contract. Upon award of contract, the General Contractor may request digital sheet files using the Electronic File and Transfer Agreement Form and its appropriate procedures and fees.

Goodwyn Mills Cawood

2400 5th Avenue South
Suite 200
Birmingham, AL 35233

T (205) 879-4462

www.gmcnetwork.com

Electronic File Conversion and Transfer Agreement

Goodwyn Mills Cawood, LLC. (GMC) in cooperation with its Consultants may, at its sole discretion, provide electronic document and file conversion services to the prime entity holding, or intending to enter into, an Agreement with an Owner for construction of a Project. GMC will typically accept only one request per project from one entity, typically the General Contractor.

Consultants referred to herein are all consultants to GMC for or in connection with the Project, including but not limited to those listed below.

It is acknowledged that neither GMC nor its Consultants are under any obligation to furnish electronic files to any party. The General Contractor and/or Sub-contractors should not, under any circumstances, assume they will receive any or all requested electronic files. Whether files are provided or not, the General Contractor remains completely responsible for performing all work required of the Contract Documents in full, including the preparation of accurate and detailed required shop-drawings.

When furnished, files will be transmitted electronically via FTP Site, or similar file transfer mechanism. It is the intent of GMC to furnish files in a timely manner, typically within two (2) weeks of receipt of payment of fees. However, the complexity and scale of the conversion is directly related to the requested file format and quantity of files requested. Where GMC believes a request will require additional time, we will notify the User and make reasonable effort to deliver files in phases if beneficial.

Please contact Alyssa Martin at (205) 879-4462 with any questions.

GOODWYN MILLS CAWOOD, LLC.

PROJECT

Project Name:

Project No.:

Document Issue Date:

Prime/Architect/Engineer: GOODWYN MILLS CAWOOD, LLC.

Consultants:

Goodwyn Mills Cawood, LLC. (hereafter "GMC"), for itself and its identified Consultants, hereby grants non-exclusive use of the requested electronic files to the party (User) listed below. User accepts that GMC and its Consultants reserve the right to convey or not convey electronic files at their sole discretion. User further agrees, as a precedent to transmittal of digital files to any other party, to require written agreement of equivalent confidentiality and indemnification provisions from any party that receives the digital files. The digital information furnished under this agreement is proprietary, is the property of GMC and/or its Consultants, and is protected by applicable copyright laws.

The information provided by GMC and/or its Consultants is solely for the convenience of the recipient. Neither GMC nor its Consultants make any warranty or guarantee, express or implied, as to the suitability of the files for any specific purpose. It is understood the files are (1) digital, (2) typically have been converted electronically into a format suitable to the User, (3) are inherently capable of being manipulated and altered through intentional and unintentional means, (4) are partial and therefore inherently incomplete representations of the Contract Documents, and (5) may include inaccuracies clarified elsewhere in the Contract documents. Consequently, ONLY the COMPLETE Printed Contract Documents, as amended, shall serve as the basis for the scope, quantity, and quality of the work required for the Project. Under no circumstances whatsoever shall GMC and/or its Consultants be or become liable to anyone for the accuracy or completeness of information included in requested electronic files. The burden of, and responsibility for, determining the fitness of data included in electronic files falls solely and completely on the User.

LIMITED USE: The use of any digital file(s) is solely limited to the listed Project below. In no event shall files be utilized for any other Project, or any use beyond the use specifically listed herein. Further, under no circumstances may the General Contractor or and Sub-Contractor submit files furnished under this Agreement as required shop drawing submittals. By execution of this Agreement, the User acknowledges these limitations, and shall comply fully therewith.

CONFIDENTIALITY: User agrees to hold Project information strictly confidential, and User agrees it shall limit the use of transmitted electronic files solely to those applications necessary to perform work required for the Project.

INDEMNIFICATION: User hereby agrees to indemnify, defend, and hold harmless GMC, its directors, officers, and employees, and its Consultants, Consultant's directors, Consultants officers and employees, and the insurers, agents, and affiliates of both GMC and its Consultants, from any and all liability including claims for consequential damages or attorney's fees that may arise out of or relate in any matter to the authorized or unauthorized use, reuse, or alteration of this information by User, its employees or agents, vendors, contractors, sub-contractors, or any other party.

REVISIONS: The Contract Documents are subject to change, and revisions are not always incorporated throughout the documents. It is the User's sole responsibility to review the complete current Contract Documents, and identify inconsistencies between the electronic files and the current Contract Documents.

DIGITAL PROTOCOL: The USER is solely responsible for examination of digital files for virus contamination. Neither GMC nor its Consultants, or the directors, officers, employees, insurers, agents, or affiliates of either are responsible for damages incurred due to virus contamination, or for software version and/or file compatibility, or any similar hardware or software compliance issues.

FEE STRUCTURE: Prior to conversion of files, GMC must receive this complete Electronic File Conversion and Transfer Agreement, completed in full, and executed by a representative of the User with authorization to enter into contracts on behalf of the User.

			PER SHEET FEE
Civil	C		$125
Architecture	A		$150
Structural	S		$125
Mechanical	M, P, FP		$125
Electrical	E		$125
Acoustical & AV	AV		$125
Other	G, FS, etc.		$100

USER ACCEPTANCE OF AGREEMENT

Company Name: _____

By: _____ Date: _____

Its: _____

REQUESTED FILE FORMAT

User (Select ONE)	File Format
☐	Bound Auto CAD Release 2007
☐	Bound Auto CAD Release 2010
☐	Bound Auto CAD Release 2013
☐	Bound Auto CAD Release 2018

SCHEDULE OF REQUESTED FILES (To be filled by User)

SHEET		INTENDED USE		FEE	
No.	Name				

(PRINT ADDITIONAL FORMS AS REQUIRED)

FORM OF CONTRACTOR'S ROOFING GUARANTEE

(Contractor refers to General and/or Roofing Contractor, jointly and severably)

Name of
Project _____

Location _____

Owner _____

General Contractor _____ Roofer _____

Address _____ Address _____

_____ _____

EFFECTIVE DATES OF GUARANTEE:

Date of Acceptance _____ Date of Expiration _____

A. The Contractor does hereby certify that the roofing work included in this contract was installed in strict accordance with all requirements of the plans and specifications and in accordance with approved roofing manufacturers recommendations.

B. The Contractor does hereby guarantee the roofing and associated work including but not limited to all flashing and counter flashing both composition and metal; roof decking and/or sheathing; all material used as a roof substrate or insulation over which roof is applied; promenade decks or any other work on the surface of the roof; metal work; gravel stops and roof expansion joints to be absolutely watertight and free from all leaks, due to faulty or defective materials and workmanship for a period of five (5) years, starting on the date of substantial completion of the project. This guarantee does not include liability for damage to interior contents of building due to roof leaks, nor does it extend to any deficiency which was caused by the failure of work which the Contractor did not damage or did not accomplish or was not charged to accomplish.

C. Subject to the terms and conditions listed below, the Contractor also guarantees that during the Guarantee Period he will, at his own cost and expense, make or cause to be made such repairs to, or replacements of said work, in accordance with the roofing manufacturers recommendations as are necessary to correct faulty and defective work and/or materials which may develop in the work including, but not limited to: blisters, delamination, exposed felts, ridges, wrinkles, splits, warped insulation and/or loose flashing, etc. in a manner pursuant to the total anticipated life of the roofing system and the best standards applicable to the particular roof type in value and in accordance with construction documents as are necessary to maintain said work in watertight conditions, and further, to respond on or within three (3) calendar days upon proper notification of leaks or defects by the Owner or Architect.

1. Specifically excluded from this Guarantee are damages to the work, other parts of the building and building contents caused by: (1) lightning, windstorm, hailstorm and other unusual phenomena of the elements; and (2) fire. When the work has been damaged by any of the foregoing causes, the Guarantee shall be null and void until such damage has been repaired by the Contractor, and until the cost and expense thereof has been paid by the Owner or by the responsible party so designated.

2. During the Guarantee Period, if the Owner allows alternation of the work by anyone other than the Contractor including cutting, patching and maintenance in connection with penetrations, and positioning of anything on the roof, this Guarantee shall become null and void upon the date of said alterations. If the Owner engages the Contractor to perform said alterations, the Guarantee shall not become null and void, unless the Contractor, prior to proceeding with said work, shall have notified the Owner in writing, showing reasonable cause for claim that said alterations would likely damage or deteriorate the work, thereby reasonably justifying a termination of this Guarantee.

3. Future building additions will not void this guarantee, except for that portion of the future addition that might affect the work under this contract at the point of connection of the roof areas, and any damage caused by such addition. If this contract is for roofing of an addition to an existing building, then this guarantee covers the work involved at the point of connection with the existing roof.

4. During the Guarantee Period, if the original use of the roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray cooled surface, flooded basin, or other use of service more severe than originally specified, this Guarantee shall become null and void upon the date of said change.

5. The Owner shall promptly notify the Contractor of observed, known or suspected leaks, defects or deterioration, and shall afford reasonable opportunity for the Contractor to inspect the work, and to examine the evidence of such leaks, defects or deterioration.

D. Standard manufacturer's roofing guarantees which contain language regarding the governing of the guarantee by any state other than the state of Alabama, must be amended to exclude such language, and shall substitute the requirement that the Laws of the State of Alabama shall govern all such guarantees.

IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, 20____.

_____	_____
General Contractor's Authorized Signature	Roofing Contractor's Authorized Signature
_____	_____
Typed Name and Title	Typed Name and Title

APPLICATION AND CERTIFICATE FOR PAYMENT FORM

1.1 Application for Payment shall be executed on AIA Document G702 Contractor's Application for Payment, along with AIA Document G703 Continuation Sheet. A draft copy is attached for reference. Copies of G702 and G703 are available for viewing in the office of the Architect, and may be purchased from an AIA documents vendor by the Contractor.

END OF APPLICATION AND CERTIFICATE FOR PAYMENT FORM

AIA® Document G702® – 1992

Application and Certificate for Payment

TO OWNER:	**PROJECT:**	**APPLICATION NO:**	**Distribution to:**
			OWNER : [ ]
		PERIOD TO:	ARCHITECT : [ ]
		CONTRACT FOR:	CONTRACTOR : [ ]
FROM	**VIA**	**CONTRACT DATE:**	FIELD : [ ]
CONTRACTOR:	**ARCHITECT:**	**PROJECT NOS:** / /	OTHER : [ ]

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract.
AIA Document G703®, Continuation Sheet, is attached.

1. ORIGINALCONTRACT SUM.....	0.00
2. NET CHANGE BY CHANGE ORDERS.....	0.00
3. CONTRACT SUM TO DATE(Line 1 ± 2).....	0.00
4. TOTAL COMPLETED & STORED TO DATE(Column G on G703).....	0.00
5. RETAINAGE:	
a. 0.00% of Completed Work (Column D + E on G703: 0.00)=	0.00
b. 0.00% of Stored Material (Column F on G703: 0.00)=	0.00
Total Retainage (Lines 5a + 5b or Total in Column I of G703).....	0.00
6. TOTAL EARNED LESS RETAINAGE..... (Line 4 Less Line 5 Total)	0.00
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT..... (Line 6 from prior Certificate)	0.00
8. CURRENT PAYMENT DUE.....	0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6)	0.00

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	0.00	0.00
Total approved this Month	0.00	0.00
TOTALS	0.00	0.00
NET CHANGES by Change Order		0.00

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

State of:

County of:

Subscribed and sworn to before me this day of

Notary Public:

My Commission expires:

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED..... 0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

DRAFT

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AIA® Document G703® – 1992

Continuation Sheet

AIA Document G702®, Application and Certification for Payment, or G732™,
Application and Certificate for Payment, Construction Manager as Adviser Edition,
containing Contractor's signed certification is attached.
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO:

APPLICATION DATE:

PERIOD TO:

ARCHITECT'S PROJECT NO:

A	B	C	D	E	F	G		H	I
			WORK COMPLETED						
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	FROM PREVIOUS APPLICATION (D + E)	THIS PERIOD	MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D + E + F)	% (G÷C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
	GRAND TOTAL	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00%**	**0.00**	**0.00**

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INVENTORY OF STORED MATERIALS

Project: **HOUSTON COUNTY DEPARTMENT OF HUMAN RESOURCES**
DOTHAN, AL

For Estimate No. _____

For Period Ending _____

Contractor:

GM&C Project No. ABHM250019

A	B	C	D	E	F
DESCRIPTION	MATERIALS STORED LAST PERIOD	PURCHASED THIS PERIOD	TOTAL COLUMNS B + C	MATERIALS USED THIS PERIOD	MATERIALS PRESENTLY STORED

To be used as documentation to support value of Stored Materials reported on APPLICATION AND CERTIFICATE FOR PAYMENT.

PROGRESS SCHEDULE AND REPORT

CONTRACTOR:

DATE OF REPORT:

PROJECT: HOUSTON COUNTY DHR
DOTHAN, ALABAMA

PROCEED DATE:

ARCHITECT: GOODWYN MILLS CAWOOD, LLC.
2400 5th Ave., S., Suite 200
Birmingham, Alabama 35233

PROJECT NO.: ABHM250019

PROJECTED COMPLETION DATE:

WORK DIVISION	%	AMOUNT													≥ MONTH
1. GENERAL REQUIREMENTS															
2. SITEWORK															
3. CONCRETE															
4. MASONRY															
5. METALS															
6. WOOD AND PLASTICS															---100%
7. THERMAL AND MOISTURE PROTECTION															-----90%
8. DOORS AND WINDOWS															-----80%
9. FINISHES															-----70%
10. SPECIALTIES															-----60%
11. EQUIPMENT															-----50%
12. FURNISHINGS															-----40%
13. SPECIAL CONSTRUCTION															-----30%
14. CONVEYING SYSTEMS															-----20%
15. MECHANICAL															-----10%
16. ELECTRICAL															------0%
TOTAL ORIGINAL CONTRACT	100%														
ANTICIPATED DRAW IN $1,000's															
ACTUAL DRAW IN $1,000's															

LEGEND: ANTICIPATED ACTIVITY — ACTUAL ACTIVITY — ANTICIPATED CASH FLOW — ACTUAL CASH FLOW

USE ADDITIONAL SHEET IF JOB IS SCHEDULED MORE THAN 12 MONTHS

CHANGE ORDER FORM

1.1 Changes to the Contract shall be made using AIA Document G701 Change Order. A draft copy is attached for reference. Copies of G701 are available for viewing in the office of the Architect, and may be purchased from an AIA documents vendor by the Contractor.

END OF CHANGE ORDER FORM

AIA® Document G701® – 2017

Change Order

PROJECT: *(Name and address)*	**CONTRACT INFORMATION:** Contract For: Date:	**CHANGE ORDER INFORMATION:** Change Order Number: Date:
OWNER: *(Name and address)*	**ARCHITECT:** *(Name and address)*	**CONTRACTOR:** *(Name and address)*

THE CONTRACT IS CHANGED AS FOLLOWS:
(Insert a detailed description of the change and, if applicable, attach or reference specific exhibits. Also include agreed upon adjustments attributable to executed Construction Change Directives.)

The original was	$ 0.00
The net change by previously authorized Change Orders	$ 0.00
The prior to this Change Order was	$ 0.00
The will be unchanged by this Change Order in the amount of	$ 0.00
The new including this Change Order will be	$ 0.00

The Contract Time will be unchanged by ( ) days.
The new date of Substantial Completion will be

NOTE: This Change Order does not include adjustments to the Contract Sum or Guaranteed Maximum Price, or the Contract Time, that have been authorized by Construction Change Directive until the cost and time have been agreed upon by both the Owner and Contractor, in which case a Change Order is executed to supersede the Construction Change Directive.

NOT VALID UNTIL SIGNED BY THE ARCHITECT, CONTRACTOR AND OWNER.

ARCHITECT *(Signature)*	**CONTRACTOR** *(Signature)*	**OWNER** *(Signature)*
(Printed name, title, and license number if required)	*(Printed name and title)*	*(Printed name and title)*
Date	*Date*	*Date*

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User Notes: (67d9d181ab647ddddca97dd3)

CERTIFICATE OF SUBSTANTIAL COMPLETION FORM

1.1 Certificate of Substantial Completion shall be executed using AIA Document G704 Certificate of Substantial Completion. A draft copy is attached for reference. Copies of G704 are available for viewing in the office of the Architect, and may be purchased from an AIA documents vendor by the Contractor.

END OF CERTIFICATE OF SUBSTANTIAL COMPLETION FORM

AIA® Document G704® – 2017

Certificate of Substantial Completion

PROJECT: *(name and address)*	**CONTRACT INFORMATION:** Contract For: Date:	**CERTIFICATE INFORMATION:** Certificate Number: Date:
OWNER: *(name and address)*	**ARCHITECT:** *(name and address)*	**CONTRACTOR:** *(name and address)*

The Work identified below has been reviewed and found, to the Architect's best knowledge, information, and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated below is the date established by this Certificate.
(Identify the Work, or portion thereof, that is substantially complete.)

ARCHITECT *(Signature)*	*(Printed name, title, and license number if required)*	*Date Of Substantial Completion*

WARRANTIES
The date of Substantial Completion of the Project or portion designated above is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:
(Identify warranties that do not commence on the date of Substantial Completion, if any, and indicate their date of commencement.)

WORK TO BE COMPLETED OR CORRECTED
A list of items to be completed or corrected is attached hereto, or transmitted as agreed upon by the parties, and identified as follows:
(Identify the list of Work to be completed or corrected.)

The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment, whichever occurs first. The Contractor will complete or correct the Work on the list of items attached hereto within ( ) days from the above date of Substantial Completion.

Cost estimate of Work to be completed or corrected: $

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work, insurance, and other items identified below shall be as follows:
(Note: Owner's and Contractor's legal and insurance counsel should review insurance requirements and coverage.)

The Owner and Contractor hereby accept the responsibilities assigned to them in this Certificate of Substantial Completion:

CONTRACTOR *(Signature)*	*(Printed name and title)*	*Date*

OWNER *(Signature)*	*(Printed name and title)*	*Date*

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User Notes: (67d9d1ed1721eb2ecf0193f7)

ADVERTISEMENT FOR COMPLETION FORM

LEGAL NOTICE

In accordance with Chapter 1, Title 39, Code of Alabama, 1975, as amended, notice is hereby given that

_____,
(*Name of Contractor*)

has completed the Contract for Construction of

_____
(*Name of Project*)

_____
(*Insert location data in County or City*)

for the _____,Owner(s), and have made request for final settlement of said Contract. All persons having any claim for labor, materials, or otherwise in connection with this project should immediately notify

GOODWYN MILLS CAWOOD, LLC.
2400 5th Avenue South, Suite 200
Birmingham, Alabama 35233
(*Architect*)

_____
(*Name of Contractor*)

_____
(*Business Address*)

_____

NOTE: This notice must be run once a week for four successive weeks in the County where the project is located for projects exceeding $50,000.00. For projects of less than $50,000.00, run one time only. Proof of publication is required, by submittal of certified ad copy in duplicate.

HOUSTON COUNTY
DEPARTMENT OF HUMAN RESOURCES

DOTHAN, ALABAMA

COMPLETED 20__

FOR THE
THE HOUSTON COUNTY PUBLIC BUILDING AUTHORITY

Name	**Title**
Name	**Title**
Name	**Title**
Name	**Title**
Name	**Title**

(Note: Obtain Names and Titles before fabricating.)

GOODWYN MILLS CAWOOD, LLC. ARCHITECT
Birmingham, Alabama

(Contractor's Name) CONTRACTOR
(Contractor's City & State)

Notes: 1. Refer to Section 10 1400 - "Signage", for additional information and requirements.
2. Approximate Size: 22-inches wide x 28-inches high.
3. Verify names, titles, and date before fabrication.

PLAQUE DETAIL – 1 REQUIRED

NOT TO SCALE

HOUSTON COUNTY
DEPARTMENT OF HUMAN RESOURCES
DOTHAN, AL

ENFRA TME, LLC Project # 12-25-0053
Client Project # ABHM250019

Index

DIVISION 21 FIRE PROTECTION SPECIFICATIONS

Section 21 0451 General Fire Protection Requirements
Section 21 0452 Identification for Fire Protection Piping and Equipment
Section 21 0453 Basic Fire Protection Materials and Methods
Section 21 0455 Fire Protection System

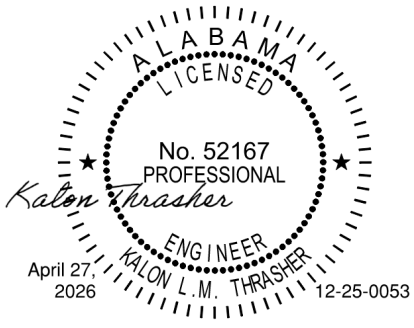
DIVISION 22 PLUMBING SPECIFICATIONS

Section 22 0401 General Plumbing Requirements
Section 22 0403 Basic Plumbing Materials and Methods
Section 22 0405 Identification for Plumbing Piping and Equipment
Section 22 0407 Plumbing Systems Insulation
Section 22 0410 Plumbing Piping
Section 22 0440 Plumbing Fixtures

DIVISION 23 HEATING VENTILATING AND AIR CONDITIONING SPECIFICATIONS

Section 23 0010 General HVAC Requirements
Section 23 0053 Basic HVAC Materials and Methods
Section 23 0054 Variable Frequency Drives
Section 23 0062 Hangers and Supports for HVAC Piping and Equipment
Section 23 0077 Identification for HVAC Piping and Equipment
Section 23 0122 Meters and Gages
Section 23 0183 Refrigerant Piping
Section 23 0513 Common Motor Requirements for HVAC Equipment
Section 23 0629 Scroll Water Chillers – Packaged Air Cooled
Section 23 0712 HVAC Systems Insulation
Section 23 0725 Custom Indoor AHU's
Section 23 0738 Mini Split System AC Units
Section 23 0762 Unit Heaters
Section 23 0775 Electric Heating Cables
Section 23 0820 Duct Accessories
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Section 23 0840 Air Terminal Units
Section 23 0855 Air Outlets and Inlets
Section 23 0900 HVAC Instrumentation and Controls
Section 23 0950 Testing, Adjusting and Balancing
Section 23 2113 Hydronic Piping
Section 23 2114 Hydronic Specialties
Section 23 3113 Metal Ducts





SECTION 01 0150
SPECIAL CONDITIONS

1.01 TIME FOR COMPLETION OF WORK:

A. The Contractor may proceed to award sub-contracts, assemble materials, etc., after written "Notice To Proceed" with Work is given by the Owner. The Contractor's official time for construction to start on work shall be the date of the Owner's written "Notice to Proceed" with Work; and completion of the Work shall be within the number of consecutive calendar days or by the date(s) indicated on the Contractor's Proposal Form.
   1. Properly supervised work, per requirements, will be permitted on Saturdays and Sundays.

B. Acceptance of the completed Work of this Contract will be at a single date, and not in phases, unless otherwise indicated.

C. All Work of this Contract shall be substantially complete within **FOUR HUNDRED EIGHTY (480)** consecutive calendar days from the Owner's official written Notice to Proceed.

D. Nothing in the Contract Documents shall permit or be construed to permit payment to the Contractor for any extended overhead or profit due to completion of the project extending beyond the Contractual completion date. In no event shall the Owner or Architect be liable to the Contractor for damage due to any delay to any portion of the Work of this Contract.

E. Delays: See Article 8.3, and related articles of AIA General Conditions.

1.02 LIQUIDATED DAMAGES:

A. Actual damages for delay in completion may be impossible to determine, and the Contractor shall be liable for and the Owner shall deduct as liquidated damages from the final payment due the Contractor, the following, in addition to 6% per annum of the total contract amount:
   1. For each calendar day of delay in completion of any part of the work beyond the number of days specified, the sum of $250.00.
   2. In the event that work on this project is incomplete and ongoing after the contractual completion date, beginning at ten (10) additional days thereafter, the Owner will also charge the Contractor, an additional $250.00 per day, for the Owner's nominal reimbursement to the Architect for continued work on the project, which charges will continue until "Substantial Completion" is accomplished.

B. The submittal of a Bid and/or Proposal by any Contractor and their Subcontractors shall be construed as, in part, acknowledgement and acceptance of these provisions.

1.03 SITE RESTRICTIONS:

A. The limits of work and known restrictions are indicated on the Site Plan and various portions of the Drawings and the Project Manual.
   1. Refer also to Section 01 1000 - "Summary of The Work," for additional information and requirements.

1.04 PRE-BID CONFERENCE:

A. Refer to "Advertisement for Prequalification and Bids" for additional information and requirements.

1.05 PRE-CONSTRUCTION CONFERENCES:

A. Refer to Section 01 3000 - "Administrative Requirements".

1.06 PRE-ROOFING CONFERENCE:

A. A pre-roofing conference is required before any roofing materials are installed. This conference shall be conducted by a representative of the Architect and attended by representatives of the Owner, General Contractor, Roofing Contractor, Sheet Metal Contractor, Roof Deck Manufacturer (if applicable) and the Roofing Materials Manufacturer (if warranty is required of

this manufacturer). If equipment of substantial size is to be placed on the roof, the Mechanical Contractor must also attend this meeting.

B. The pre-roofing conference is intended to clarify demolition (for renovation or re-roofing projects) and application requirements for work to be completed before roofing operations can begin. This would include a detailed review of the specifications, roof plans, roof deck information, flashing details and approved shop drawings, submittal data, and samples. If conflict exists between the specifications and the Manufacturer's requirements, this shall be resolved. If this pre-roofing conference cannot be satisfactorily concluded without further inspection and investigation by any of the parties present, it shall be reconvened at the earliest possible time to avoid delay of the work. In no case should the work proceed without inspection of all roof deck areas and substantial agreement on all points.

C. The following are to be accomplished during the conference:
   1. Review all Factory Mutual and Underwriters Laboratories requirements listed in the specifications and resolve any questions or conflicts that ay arise.
   2. Establish trade-related job schedules, including the installation of roof-mounted mechanical equipment.
   3. Establish roofing schedule and work methods that will prevent roof damage.
   4. Require that all roof penetrations and walls be in place prior to installing the roof.
   5. Establish those areas on the job site that will be designated as work and storage areas for roofing operations.
   6. Establish weather and working temperature conditions to which all parties must agree.
   7. Establish acceptable methods of protecting the finished roof if any trades must travel across or work on or above any areas of the finished roof.

D. The Architect shall prepare a written report indicating actions taken and decisions made at this pre-roofing conference. This report shall be made a part of the project record and copies furnished the General Contractor, and the Owner.

E. Refer to Section 01 3000 - "Administrative Requirements" for additional information and requirements.

1.07 CONTRACTOR ACCESS TO SITE:

A. The Contractor will have access to the site immediately upon receipt of the Owner's written Notice to Proceed with work. All routes of access to the site and gate locations by the Contractor or their subcontractors, are subject to approval by Owner, Architect, and other authorities having jurisdiction. Check site plan for location of work limits. Refer to Section 01 1000 - “Summary of The Work” and Section 01 5000 - “Temporary Facilities,” for additional information and requirements.

B. The Contractor shall be required to coordinate the Work of the project with the Owner’s activities, to the extent that the Work of this Contract has little or no effect on normal operations.

1.08 CONTRACTOR’S PLAN FOR CONSTRUCTION OF PROJECT:

A. Contractor shall prepare and submit within 7 days from award of contract to the Architect for review and approval a Bar Graph, indicating his proposed plan and sequence of operations to complete each phase of this project, on schedule as required by contract. This Bar Graph is expected to be a Critical Path graph.
   1. Schedule should identify project milestones and expected durations.

B. Refer to Section 01 3216 - "Construction Progress Schedule" for additional information and requirements.

1.09 CONTRACTOR JOB MEETINGS:

A. On-Site Meetings with Architect , and various trades, general contractors and subcontractors, shall be conducted by the Contractor as directed by the Architect for purpose of furthering the progress of the work, solving construction problems, and issuing instructions.

B. Refer to “Pre-construction Conferences” paragraph above, “General Conditions of the Contract”, and Section 01 3000 - "Administrative Requirements" for additional information and requirements.

1.10 STORED MATERIALS:

A. It is recognized that the size of the site is restrictive and that it may be necessary for the Contractor to store some materials for project at locations on the site, prior to removal or disposal. When such on site storage is necessary, comply with requirements of authorities having jurisdiction, including in part, on site retention of earth, storm water run-off, slopes of debris, earth, etc.

B. Store items to be incorporated in the Work in stable and secure manner, off of ground, separated by hardwood or treated wood blocking, and under cover or in storage building.
   1. Any materials found stored directly on ground or paving, in standing water, etc., will be rejected, immediately removed from site, and replaced with new materials at the Contractor’s expense.
   2. Distribute materials around framing and the roof in such manner as to prevent any damage to structure, construction, improvements, etc.

C. Refer to Section 01 6000 - “Product Requirements”, for additional information and requirements for any off-site stored materials.

1.11 PROTECTION:

A. The Contractor shall provide and maintain adequate fencing and barricades, where indicated, and wherever required. Building entrances and exits shall remain unobstructed at all times when buildings are occupied.

B. The Contractor shall provide suitable protection for all employees, the public, students, children, users of other adjacent facilities, and the occupants of existing buildings at all times during the execution of and until the completion of the Work.
   1. Construction equipment shall not come in contact with or swing over existing facilities to remain, public areas, occupied buildings, right-of-ways, etc., which are to remain.

C. The Contractor shall avoid damage as a result of their operations, to the existing buildings, walks, pavement, curbs, grass, shrubbery, trees, utilities, adjoining property, etc., and shall at his/her own expense, completely repair any damage thereto caused by his operations. All repair work is subject to Architect’s approval, and that of its Owner.

D. Refer to Section 01 5000 - "Temporary Facilities and Controls" for additional information and requirements.

1.12 WORK LIMITS PROTECTION:

A. The Contractor shall locate all temporary buildings, storage of equipment, materials, etc., within a protected area to protect the public, and others from the construction activities. Type and location of such protection shall be as existing at the site, or if not existing or complete, as proposed and furnished by the Contractor, subject to acceptance of the Architect, Owner, and authorities having jurisdiction.

B. Refer to Section 01 5000 - "Temporary Facilities and Controls" for additional information and requirements.

1.13 EMPLOYMENT OF AND PAYMENT FOR TESTING SERVICES:

A. The following information regarding Employment of and Payment for Testing Services under the work of Specifications shall take precedence over any conflicting statements otherwise, which may have remained in the Project Manual after editing:
   1. Initial testing required by the Contract Documents for Divisions 2 through 5, and Divisions 31-33 (except not utility systems testing) shall be provided by an independent testing agency selected, employed and paid by the Owner.

2. Initial testing required by the Contract Documents for all other testing and Divisions 6 through 26 shall be provided by a testing agency acceptable to the Owner, and selected, employed, and paid by the Contractor from his/her Contract amount.
3. Any retesting required (due to failure of initial testing to meet the requirements of the Contract Documents) shall be at the Contractor's expense.
4. Any retesting required (due to questionable materials or construction methods, for verification purposes, and etc.) shall be at the Contractor's expense when the results of such retesting indicate any work or materials do not comply with requirements of the Contract Documents. Otherwise, such retesting will be at Owner's expense.
5. Any retesting under the above provisions shall be performed by the same Owner accepted testing agency.
6. Nothing in the Contract Documents shall prevent the Contractor from performing any other or additional Quality Control testing at his/her own expense, to verify compliance with the Bid and Contract Documents.

B. The Contractor shall be responsible for contacting and directions to the accepted testing agency and for any follow-up communications required, for all testing required by the Contract Documents.

C. No unsuitable or unsatisfactory existing soils or building materials (other than work in Contract) shall be removed without either the presence of or concurrence of and prior approval of the Architect and the accepted testing agency, so as to assure quality of the Work is maintained, and to verify quantities of any additional work under bid "Unit Prices", for which the Contractor is due payment by the Owner.

D. The Contractor shall be responsible for contacting and directions to the accepted testing agency and for any follow-up communications required, for all testing required by the Contract Documents.

E. Refer to Section 01 4000 - "Quality Requirements" for additional information and requirements.

1.14 PROHIBITED MATERIALS:

A. ASBESTOS: All materials, equipment, components, accessories, and etc., installed in the work of this contract, both field installed and bought-out manufactured items from any source shall be 100-percent free of asbestos.

B. LEAD CONTENT: All water-bearing lines, water dispensing equipment, finish materials, and paint other than exposed exterior roof flashings, shall be 100-percent free of lead.

C. CALCIUM CHLORIDE: Calcium chloride and/or derivatives or additives thereof shall not be permitted in any concrete, concrete product, grout, masonry and/or mortar.

D. ENVIRONMENTAL REGULATIONS: All materials, their application, installation, and completion, shall comply with applicable environmental regulations, including in part, erosion, air-borne contaminants, and volatile organic compounds (VOC's).

E. FORMALDEHYDE: All insulation and other products shall be 100-percent free of formaldehyde.

1.15 PROHIBITED EQUIPMENT:

A. The elevated and framed floor slabs are not designed to accommodate heavy rolling point loads. Scissor lifts are not permitted on any elevated or framed slab during the construction of the project.

1.16 PERSONNEL EXPERIENCE AND SUPERINTENDENTS:

A. Subcontractors shall have no less than 5-years verifiable experience in their trade and no less than 5-years verifiable experience in their business enterprise contracting for work under this project; The type of work subcontracted for this project shall be the principal business of the Subcontractor.

B. Superintendents and foremen, or other individual in the lead or supervisory position for any portion of the Work under this Contract shall have no less than 7-years verifiable experience in performing the type of work they are responsible for.
   1. The Contractor shall submit resumes of work and project experience for their Superintendent and foremen, as soon as possible and at least within five calendar days of receipt of the Contract to be executed for the work, for review and acceptance by the Owner and Architect.
   2. If the Superintendent is replaced on the job after work begins, the same qualifications as above apply. Submit for review and acceptance by the Owner and Architect.

1.17 SUBMITTALS:

A. Submittal requirements are indicated throughout the Contract Documents, and the following supplements those requirements.
   1. Contractor will be required to make submittals for every item and product so indicated; Also upon request, for any additional or other item or products intended for use or incorporation in the Work.

      a. The Contractor shall submit to the Architect within 30 days of “Notice to Proceed”, a complete listing of all required submittals, warranties, guarantees, close-out documents, and materials requiring extra or “attic” stock delivered to the Owner, for review and acceptance. Include for each item, the anticipated date of Submittal to the Architect. Re-submit until accepted or approved.
   2. The Contractor shall review, mark all necessary changes, revisions, and questions; and then stamp, sign, approve, and submit to the Architect, all Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, and shall do so with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner, or of separate contractors.
      a. The Contractor shall not make submittals to the Architect which they have not reviewed, stamped, signed and approved by the Contractor; or in such case, no action will be taken by the Architect or their Consultants regarding that or those submittals.
   3. The Contractor shall submit number of copies for review as indicated in Section 01 3000 - Administrative Requirements.
   4. Review time will be limited to two weeks, except for more complex submittals, such as Structural, and Divisions 21-26.
   5. Colors will not be selected until most or all submittals required have been received and reviewed. Actual color chip samples shall be required along with standard color selection paperwork. No exceptions.
   6. Samples: Submit the number specified in Section 01 3000.
   7. Submit test reports as required or otherwise requested, in the same quantity as other submittal data.
   8. Contractor shall provide letter from Mechanical Contractor stating the Mechanical Contractor has coordinated all power requirements with the Electrical Contractor. Mechanical submittals will not be reviewed without receipt of this letter.
   9. Contractor shall distribute reviewed submittals to all concerned and appropriate Subcontractors and Suppliers.
   10. Contractor shall maintain 1-set of reviewed and approved submittals at his on-site job office.

B. Review and/or approval of submittals by the Architect, Owner and/or their Consultants shall not relieve the Contractor of his responsibility to comply with the requirements of the Contract Documents.
   1. Any proposed change in the Work shall be submitted separate from any other item during construction, with same documentation as pre-bid requests, or they will not be considered.
   2. No actual or proposed change shall be included in Shop Drawings or other Construction submittals, and none so included will be considered approved under any circumstances.

3. Shop Drawings are communications between the Contractor and various suppliers, fabricators, and subcontractors. The design professional's role is to review the drawings to answer questions that arise about design intent.
4. Even if a reviewed Shop Drawing or other Submittal has deviations from the original design and the Contract Documents, it in itself is not a Change Order and it is not, IN ITSELF, an approval of the change. Changes can only be approved by Change Order.
5. Dimensions, quantities, and coordination remain the Contractor's responsibility.

C. Refer to Section 01 3000 - "Administrative Requirements" for additional information and requirements.

1.18 SITE MAINTENANCE:

A. The Owner will require all mud or debris resulting from this construction to be removed from streets, sidewalks, etc., by the Contractor as it appears, one or more times daily.

B. Trash, debris, etc., must be removed from the site as Contractor's trash cans, waste receptacles, etc., are filled. Same will not be allowed to accumulate or blow around the site, within the buildings, etc.

C. The Contractor shall be responsible for maintaining existing landscaping and lawns within and below any construction fencing, for the duration of the Work of the Contract, or until any such fencing is removed.

D. Refer to Sections 01 1000, 01 5000, 01 7000 and other locations in the Bid and Contract Documents for additional information and requirements.

1.19 INSURANCE AND SPECIAL PROVISIONS:

A. The Contractor and their insurer, by execution of the Contract, shall waive all rights of subrogation against "the Owner, the Architect, and their Consultants", and same shall be indicated on all insurance provided by the Contractor and each Subcontractor.

B. The Contractor and their insurer, and each Subcontractor, shall name "the Owner, Architect, and their Consultants", as additional named primary insureds on all insurance provided by the Contractor and each Subcontractor, except not for "Workers Compensation and Employers Liability".

C. Refer to "General Conditions" and other portions of the Bid and Contract Documents, for additional information and insurance requirements. Note that Builder's Risk insurance is required, as described in "General Conditions", as modified by "Supplementary Conditions".
1. Extent of coverage required and/or any approval or acceptance of the insurance carried shall not act to modify the liability of the Contractor, nor to imply that the limits, features and/or coverages described are adequate to protect the interests or exposures of the Contractor.

D. The Contractor shall "hold harmless" and indemnify the Owner, Architect, and their Consultants from any claim or legal action resulting from any circumstances related to the Work of this project, including in part, payment of any legal or other expenses, fines, judgments, etc.

E. Insurance policies required by the Contract Documents shall not be canceled, altered, or changed, without first having given thirty (30) days written notice to the Owner, with a copy sent to the Architect, except ten(10) days written notice for non-payment of premium.
1. Copies of all policies, endorsements, and insurance certificates, including new, renewed, altered, and/or changed during this Contract shall be delivered to the Owner within ten (10) days of effective date(s), with a copy sent to the Architect, by the Contractor.

F. Refer to General Conditions of the Contract for additional information and requirements regarding minimum insurance and indemnity requirements.

G. Special Provision: Nothing in this or other paragraphs of the Contract Documents shall create or give to third parties any claim or right of action beyond such as may legally exist irrespective of the Contract.

1.20 ACCESSIBILITY OF ALL COMPLETED WORK:

A. All products and installations of the Work of this Contract, shall be as designed by the fabricator, manufacturer, etc., and installed by the Contractor, Subcontractors, etc., so as to provide full accessibility to the handicapped and/or disabled, unless specifically indicated otherwise. This shall include in part, the following:
   1. Mounting heights of all electrical devices, switches, etc., all designated plumbing fixtures, and their operation, in all areas except mechanical and electrical rooms, and service areas which are not accessible at any time to the public or Owner's administrative (not service or maintenance) personnel.
   2. Signage.
   3. Door operation and hardware.
   4. Elevator (if any).
   5. Slip resistance of all completed flooring and walkway surfaces both interior and exterior.

B. Comply with the more stringent requirements of at least the following, either the latest edition or latest adopted edition of the locality, and all revisions and amendments thereto:
   1. Uniform Federal Accessibility Standards (UFAS).
   2. Americans With Disabilities Act of 1990 (ADA) "Accessibility Guidelines" (ADA-AG), and all revisions and amendments thereto.
   3. American National Standards Institute (ANSI), ANSI A 117.1.
   4. U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA "Accessibility Guidelines" (ADA-AG), Published in the Federal Register July 23, 2004, and revisions and amendments thereto.
   5. International Building Code, as applicable at the project locale.

1.21 CONTRACTOR PROGRAMS AND CONDUCT OF PERSONNEL:

A. The Contractor shall implement programs and make literature available to all construction and administration personnel to encourage making this project a safe place to work, including in part the following requirements: A project site free of any substance abuse, which does not allow any consumption of alcohol, and which does not allow any work to be performed while under the influence of any debilitating substance.
   1. The Contractor and every Subcontractor shall have as part of their personnel, safety, substance abuse prevention, and/or quality programs, mandatory drug testing at pre-employment, post-accident, and at random during employees' tenure with their firms. Each such entity shall be prepared to provide non-confidential verification to the Owner that such testing is consistently on-going, upon Owner's request for same.

B. Programs shall be as acceptable to or recommended by one or more of the following:
   1. Contractor's Underwriter for Worker's Compensation or liability insurance.
   2. OSHA.
   3. Associated General Contractors.
   4. U.S. Department of Defense, Corps of Engineers, or Veterans Administration.

C. Conduct of all personnel employed for the Work of this project shall be held to a high standard and shall not be offensive to others on or around the site, including in part, pedestrians, the public, the Owner, Owner's Consultants, etc.
   1. The Contractor and their employees shall limit any discussion of the Work of this project to the Owner's representative named in the front of this Project Manual, inspecting authorities with jurisdiction, and the Architect; In no instance shall this project be discussed with others, except as may otherwise be indicated herein.

   2. The Contractor's personnel and Subcontractors shall not enter the Owner's building, nor use the Owner's telephones (except in emergencies), or the Owner's restrooms.

D. The Contractor shall immediately dismiss and escort off of the project site, any personnel who are obviously under the influence of alcohol or other debilitating substance, and any personnel

exhibiting offensive behavior as described above or by law or by local statute or regulations of authorities having jurisdiction.

1.22 WORK BY OTHERS:

A. The following items of work are to be provided by others, and are Not in Contract (N.I.C.). The Contractor will be required to coordinate with the Owner as necessary to accommodate provisions for these items.
   1. Movable furniture, furnishings, office equipment, library equipment, and movable library shelving unless otherwise indicated.
   2. Listed Equipment, residential appliances, and items of Alternate work not accepted at this time, and/or indicated “Not In Contract”, “N.I.C.”, “Future”, and/or similar indication.
      a. Unless otherwise indicated, coordination, locating, and providing rough-ins for all power, water supply, gas, drains, drain lines, condensate drain outlet, and other utilities required for such equipment, casework, etc., and preparation required for the addition of future finishes (same as level of finish required for the finishes included in Bid, just prior to finishes being added), shall be included in Base Bid;

B. Refer to Section 01 1000 - "Summary of The Work" for additional information and requirements.

1.23 SELECTIVE DEMOLITION:

A. Section 02 4100 - “Demolition,” is applicable to the entire Work of this project and not just to Division 2 where it occurs.

1.24 INSPECTIONS:

A. See Section 01 3000 - Administrative Requirements for information on Scheduling of Inspections, and Minimum Requirements for Required Inspections.

1.25 USER FEES:

A. The Contractor is hereby advised that, if applicable, any administrative fees in the form of a Permit Fee shall be paid by the Contractor.

END OF SECTION

SECTION 01 1000
SUMMARY OF THE WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND GENERAL INFORMATION

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to work of this section.

1.02 PROJECT/WORK IDENTIFICATION

A. General: Project name is "HOUSTON COUNTY DEPARTMENT OF HUMAN RESOURCES, for THE HOUSTON PUBLIC BUILDING AUTHORITY, DOTHAN, ALABAMA", as shown on the Contract Documents prepared by Goodwyn Mills Cawood, LLC., dated November 14, 2025.

B. Contract Documents indicate the work of the Contract and related requirements and conditions that have an impact on the project.

C. Summary by References: Work of the Contract can be summarized by references to the Contract, General Conditions, Supplementary Conditions (if any), the Project Manual, Technical Specification Sections, Drawings, Addenda and modifications to the Contract Documents issued subsequent to the initial printing of this Project Manual and the Drawings, and including but not necessarily limited to printed material referenced by any of these. It is recognized that the Work of the Contract is also unavoidably affected or influenced by governing regulations, natural phenomenon including weather conditions, and other forces outside the contract documents.

D. Abbreviated Written Summary: Briefly and without force and effect upon the contract documents, the Work of the Contract can be summarized as follows:
   1. The Work includes construction of new building, and related work, as required to complete the facilities as indicated on the Drawings and in the Project Manual.

1.03 CONTRACTOR USE OF PREMISES

A. General: During the entire construction period the Contractor shall have the exclusive use of the premises for construction operations, including full use of the site as shown on the Drawings.
   1. Limitations of exclusive use of the site:
      a. Confine operations at the site to the areas permitted under the Contract. Portions of the site beyond areas on which work is indicated are not to be disturbed. Conform to applicable rules and regulations affecting the work while engaged in project construction. See site plan for egress and ingress to site, or if not indicated, same shall be as designated by the Owner.
      b. Keep existing public roads, driveways and entrances serving the premises clear and available at all times. Do not use these areas for parking or storage of materials. Remove dirt, mud, debris, etc., from site, sidewalks, streets, and public right-of-way as it occurs.
      c. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage sheds to the areas indicated. If additional storage is necessary, obtain and pay for such storage off site in a fully bonded and insured facility acceptable to the Owner, with all items stored clearly identified as being assigned to this project.
      d. Lock automotive type vehicles, such as passenger cars and trucks and other mechanized or motorized construction equipment, when parked and unattended, so as to prevent unauthorized use. Do not leave such vehicles or equipment unattended with the motor running, or the ignition key in place.
      e. The Owner, and their representatives, the Architect and their Consultants, as well as authorities having jurisdiction will require site accessibility for inspections, observations, and perhaps other purposes, related to the planned new construction.

The Contractor shall assist in such accessibility, to at least the point of providing and maintaining reasonably accessible dry paths to work in progress.

f. Construction operations shall not effect in any manner, the on-going operations of the Owner, immediately adjacent facilities, adjacent property owners or businesses, or others. Refer to Division 1 Section "Special Conditions" for additional information and requirements regarding coordination with Owner's activities.
   1) Construction equipment shall not come in contact with or swing over existing facilities to remain, public areas, occupied buildings, right-of-ways, etc., which are to remain.

g. The Contractor and their employees shall limit any discussion of the Work of this project to the Owner's representatives named in the front of this Project Manual, Consultants employed, inspecting authorities with jurisdiction, and the Architect. In no instance shall this project be discussed with others, except as may otherwise be indicated herein.

h. Parking on-site, if any, shall be limited to the "staging areas" indicated on the Drawings, or if not indicated, as mutually agreed between the Owner, Architect, and Contractor at the Pre-Construction Conference.

i. Smoking or other use of tobacco products shall not be permitted within the Owner's facilities or on roofs.

j. The use or presence of alcohol and/or other debilitating substances shall not be permitted on the project site.

k. Firearms and/or other weapons shall not be permitted on the project site.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 2100
ALLOWANCES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to the work of this Section.

B. Coordinate allowance work with related work to ensure that it is completely integrated and interfaced with related work.

1.02 DESCRIPTION OF REQUIREMENTS:

A. Definitions and Explanations: Certain requirements of the work related to each allowance are shown and specified in contract documents. The allowance has been established in lieu of additional requirements for that work, and further requirements thereof (if any) will be issued by change order.

B. Types of allowances scheduled herein for the work included the following:
   1. Unit cost allowances.
   2. Lump sum allowances.

C. Selection and Purchase:
   1. At earliest feasible date after award of Contract, advise Architect/Engineer of scheduled date when final selection and purchase of each product or system described by each allowance must be accomplished in order to avoid delays in performance of the work.
   2. As requested by the Architect/Engineer, obtain and submit proposals for the work of each allowance for use in making final selections; include recommendations for selection which are relevant to the proper performance of the work.
   3. Purchase products and systems as specified, and as selected (in writing) by the Architect/Engineer.
   4. Submit proposals and recommendations, for purchase of products or systems of allowances, in form specified for change orders.

D. Change Order Data: Include in each change order proposal both the quantities of products being purchased and unit costs, along with total amount of purchases to be made. Where requested, furnish survey-of-requirements data to substantiate quantities. Indicate applicable delivery charges, amounts of applicable trade discounts, and other relevant details as requested by the Architect.
   1. Each change order amount for allowances shall be based on the unit price difference between the actual purchase amount and the allowance, multiplied by the final measure or count of work-in-place, with reasonable allowances, where applicable, for cutting losses, tolerances, mixing wastes, normal product imperfections and similar margins.
   2. Include overhead and profit in the Contractor's Allowance.
   3. When requested, prepare explanations and documentation to substantiate the quantities, costs, and margins as claimed.

E. Change Order Mark-Up:
   1. Except as otherwise indicated, comply with provisions of General Conditions. For each allowance, Contractor's claims for increased costs (for either purchase amount or Contractor's handling, labor, installation, overhead, and profit), because of a change in scope or nature of the allowance work as described in contract documents, must be submitted within 60 days of initial change order authorizing work to proceed on that allowance; otherwise, such claims will be rejected.
   2. Where it is not economically feasible to return unused material to the manufacturer/supplier for credit, prepare unused material for the Owner's storage, and deliver to the Owner's storage space as directed. Otherwise, disposal of excess material is the Contractor's responsibility.

F. Time and Allowance Amounts:

1. Nothing in the Bid or Contract Documents shall be so constructed or interpreted as to provide a Contract time extension, due to use or non-use of any Allowance amount.
2. Nothing in the Bid or Contract Documents shall be so constructed or interpreted as to allow unused Allowances or any portion thereof, nor any overhead and profit therefor to be retained by or paid to the Contractor.
3. Full amount of unused allowances shall be returned to the Owner.

PART 2 PRODUCTS - NOT USED PART 3 EXECUTION - NOT USED

2.01 SCHEDULE OF ALLOWANCES:

A. Allowance No. 1 – INTERIOR DOOR SIGNAGE AND EVACUATION MAP SIGNAGE:
   1. Allow a unit price of $100.00 each for Room Signs for each door, and each of (10) Evacuation Map signs, including purchase, delivery to jobsite, and all related costs, in accordance with Section 10 1400 – “Signage” Selections and Copy will be furnished by Architect after bidding.
   2. Installation and installation material costs shall be included in Allowance, and not as a part of Base Bid.
   3. Overhead and Profit shall be included in Base Bid, and not part of Allowance.
   4. Building Plaques are to be included in Base Bid, and not as part of Allowance.
   5. Calculating Allowance:
      a. Unit Price of $100 per room sign and evacuation map.
      b. Qua
      c. Total Allowance Value (a x b): $_____

B. Allowance No. 2 – INTERIOR SIGNAGE ON GLASS:
   1. Allow a Lump Sum price of $2,000.00 for Vinyl Signage with Logo on glass. Specific verbiage and type of lettering will be selected by Architect after bidding.
   2. Installation and installation material costs shall be included in Allowance, and not as a part of Base Bid.
   3. Overhead and Profit shall be included in Base Bid, and not part of Allowance.

C. Allowance No. 3 – EXTERIOR BUILDING AND MONUMENT SIGNAGE:
   1. Allow a Lump Sum price of $8,000.00 for the purchase of Mounted Cast Architectural Letters for the Monument sign and miscellaneous exterior signs, including purchase, delivery to jobsite, and all related costs, in accordance with Section 10 1400 – “Signage” Selections and Copy will be furnished by Architect after bidding.
   2. Installation and installation material costs shall be included in Allowance, and not as a part of Base Bid.
   3. Overhead and Profit shall be included in Base Bid, and not part of Allowance.

D. Allowance No. 4 – TELEVISIONS:
   1. Allow a unit price of $5,000.00 each for each flat screen television and DVD player, including purchase, delivery to jobsite, and all related costs. Specific selections will be furnished by Architect after bidding.
   2. Installation and installation material costs shall be included in Allowance, and not as a part of Base Bid.
   3. Overhead and Profit shall be included in Base Bid, and not part of Allowance.
   4. Calculating Allowance:
      a. Unit price of $5,000 per flat screen television and DVD p
      b. Quantity: _____
      c. Total Allowance Value (a x b): $_____

E. Allowance No. 5 - BRICK MASONRY:
   1. Field Brick: Allow a unit cost of $800.00 per thousand for brick units, including purchase, delivery to the job site, and all related costs. Colors to be selected by Architect.
   2. Include overhead and profit in Base Bid, and not as part of Allowance.
   3. Installation of brick masonry and mortar installation and installation materials (grout, ties, reinforcing, etc.) shall be included in Base Bid, and not as part of Allowance.

4. Concrete masonry units (CMU), mortar, installation, and installation materials (grout, ties, reinforcing, etc.) shall be in Base Bid, and not as part of Allowance.
5. The brick will be modular (7-5/8" x 2-1/4" x 3-5/8" depth), unless otherwise indicated, selected by Architect after bidding, with special shapes as indicated and specified.
6. Calculating Allowance:
   a. Unit price of $800 per thousand brick units.
   b. Quantity: _____
   c. Total Allowance Value (a x b): $_____

F. Allowance No. 6 - MASONRY MORTAR:
1. Allow a unit cost of $22.00 per bag, for the purchase of up to one (1) color of colored mortar, delivered to the job site, including all related expenses.
2. Include overhead and profit in Base Bid, and not as part of Allowance.
3. Masonry, standard gray mortar at interior (painted and unpainted walls - see Finish Schedule), concealed masonry work, and all mortar installation and installation materials (grout, ties, reinforcing, etc.) shall be included in Base Bid, and not as part of Allowance.
4. Mortar color will be selected by the Architect, after award of the Contract for construction of this project.
5. Calculating Allowance:
   a. Unit Price of $22 per
   b. Quantity: _____
   c. Total Allowance Value (a x b): $_____

G. Allowance No. 7 - UNDERCUT AND BACKFILL IN BUILDING CONTROL AREA
1. In accordance with Section 01 2200 - Unit Prices and Section 31 2000 - Earth Moving, include an Allowance for the quantity identified. The Allowance value will be adjusted up or down based on the actual quantity of the Work.
2. See Section 01 2200 - Unit Prices for costs to be included and procedures for payment of Unit Price work.
3. Calculating Allowance:
   a. Unit Price Item A: Undercut and Backfill in Building Control Area
   b. Quantity of TWO THOUSAND (2,000) Cubic Yards (CY)
   c. Unit Price for each CY $_____
   d. Total Allowance Value (b x c): $_____

H. Allowance No. 8 - UNDERCUT AND BACKFILL IN PAVEMENT CONTROL AREA
1. In accordance with Section 01 2200 - Unit Prices and Section 31 2000 - Earth Moving, include an Allowance for the quantity identified. Undercut and Backfill illustrated in the drawings and spcified herein shall be included in the Base Bid, not ass part of Allowance. The Allowance value will be adjusted up or down based on the actual quant
2. See Section 01 2200 - Unit Prices for costs to be included and procedures for payment of Unit Price work.
3. Calculating Allowance:
   a. Unit Price Item B: Undercut and Backfill in Pavement Control Area
   b. Quantity of ONE THOUSAND NINE HUNDRED FIFTY (1,950) Cubic Yards (CY)
   c. Unit Price for each CY $_____
   d. Total Allowance Value (b x c): $_____

I. Allowance No. 9 - GEOTEXTILE FABRIC FOR SUBGRADE STABILIZATION
1. In accordance with Section 01 2200 - Unit Prices, include an allowance for the quantity identified. The Allowance value will be adjusted up or down based on the actual quantity of the work.
2. See Section 01 2200 - Unit Prices for costs to be included and procedures for payment of Unit Price work.
3. Calculating Allowance:
   a. Unit Price Item 17: Geotextile Fabric for Subgrade Stabilization.

b. Quantity: FIVE THOUSAND EIGHT HUNDRED TWENTY-FIVE Square Yards (5,825 SY).
c. Unit Price for each SY: $_____
d. Total Allowance Value (b x c): $_____

J. Allowance No. 10 - DENSE GRADE BASE FOR SUBGRADE STABILIZATION
1. In accorcdance with Section 01 2200 - Unit Prices, include an allowance for the quantity identified. The Allowance value will be adjusted up or down based on the actual quantity of the Work.
2. See Section 01 2200 - Unit Prices for costs to be included and procedures for payment of Unit Price work.
3. Calculating Allowance:
a. Unit Price Item 18: Dense Grade Base for Subgrade Stabilization
b. Quantity: TWO THOUSAND THREE HUNDRED FIFTY Tons (2,350 TN)
c. Unit Price for each TN: $_____
d. Total Allowance Value (b x c): $_____

K. Allowance No. 11 - CONTINGENCY:
1. Allow a lump sum price of $100,000.00 as a Contingency Allowance.
2. Overhead and Profit shall be in Base Bid, and not part of Allowance.

L. Allowance No. 12 - AIDE TO CONSTRUCT
1. Allow a lump sum price of $100,000 as an Aide to Construct Allowance.
2. Overhead and Profit shall be in Base Bid, and not part of Allowance.

M. Allowance No. 13 - EMERGENCY RESPONDER RADIO SYSTEM (DAS):
1. Allow a lump sum of $60,000.00 for purchase of Emergency Responder Radio System.
2. Include installation of material costs in Allowance.
3. Include overhead and profit in Allowance and not part of Base Bid.

END OF SECTION

SECTION 01 2200
UNIT PRICES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies administrative and procedural requirements for unit prices.
   1. A unit price is an amount proposed by Bidders and stated on "Attachment A to Proposal Form", as a price per unit of measurement for materials and/or services that will be added to or deducted from the Contract Sum by Change Order in the event the estimated quantities of Work required by the Contract Documents are increased or decreased, in accordance the General Conditions and/or other provisions of the Bid and Contract Documents.
   2. Unit prices shall include all necessary material, labor, fees, layout, supervision (field and home office), general expenses, insurance, bonds, overhead, profit and applicable taxes, for unit item of work in place.
   3. Refer to other Division 1 Sections and individual Specification Sections for construction activities requiring the establishment of unit prices. Methods of approval, verification, measurement and payment for unit prices are specified in those sections.

B. Related work specified elsewhere includes:
   1. Section 01 0150 - Special Conditions.
   2. Division 2 - Existing Conditions Sections.
   3. Division 3 - Concrete Sections.
   4. Division 7 - Thermal and Moisture Protection Sections.
   5. Division 8 - Openings Sections.
   6. Division 9 - Finishes Sections.
   7. Division 10 - Specialties Sections.
   8. Division 11 - Equipment Section.
   9. Divisions 31-35 - Site Work Divisions.

C. Schedule:
   1. A "Unit Price Schedule" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods described under each unit price.
   2. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established unit prices, and to have this work measured by an independent surveyor acceptable to the Contractor at the Owner's expense.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 ITEMIZED UNIT PRICE SCHEDULE

A. Item No. 1 - Sod:
   1. Description: Provide additional sod as directed, including fine grading, soil amendments, fertilizers, sod, maintenance, etc., as specified in Division 32 Sections relating to "Landscape Work".
   2. Unit of Measure: Square yard (SY) of sod, in place.

B. Item No. 2 - Concrete Mud Footings:
   1. Description: Provide additional concrete mud footings, in addition to any mud footings indicated on the Drawings, as specified in Section 03 3100 - “Concrete”, as directed, where required by the Project Geotechnical Consultant due to any existing unsuitable soils.
   2. Unit of Measure: Cubic yard (CY) of concrete mud footings, in place.
   3. Note: This unit price is not applicable to cost of mud footings that are required due to over-excavation, or due to not pouring footings the same date they are excavated, or other reasons indicated in Section 31 2000 - “Earth Moving,” or Section 03 3100 - “Concrete”.

C. Item No. 3 - Undercut & Backfill in Building Control Areas:
   1. Description: Undercutting below planned subgrade in building control areas, and at least 10-feet beyond, as required due to careful inspection by probing, proofrolling, and testing shall be paid on a unit price basis per cubic yard of undercut. Unit price shall include excavation and legal off-site disposal of unsuitable material and replacement with compacted controlled fill back to subgrade elevation in cuts and back to original grade in fills in accordance with Section 31 3200 - "Earth Moving". This shall not apply to previously prepared areas of the site that may become unstable due to construction traffic, rain, etc.
   2. Unit of Measure: Cubic Yard (CY) of unsuitable material.

D. Item No. 4 - Undercut & Backfill in Non-Building Control Areas.
   1. Description: Undercutting below planned subgrade in all areas not included in the building control areas as required due to careful inspection by probing, proofrollling, and testing shall be paid on a unit price basis per cubic yard of undercut. Unit price shall include excavation and legal off-site disposal of unsuitable material and replacement with compacted controlled fill back to subgrade elevation in cuts and back to original grade in fills in accordance with Section 31 2000 - "Earth Moving". This shall not apply to previously prepared areas of the site that may become unstable due to construction traffic, rain, etc.
   2. Unit of Measure: Cubic Yard (CY) of unsuitable material.

E. Item No. 5 - Concrete Sidewalk.
   1. Description: Install concrete sidewalk not otherwise shown on drawings, in location directed by Architect.
   2. Unit of Measure: Square Foot (SF) of sidewalk installed.

F. Item No. 6 - Chain Link Fence:
   1. Description: Install chain link fence not otherwise shown on drawings, as specified in Section 32 3113 - "Chain Link Fences and Gates", in location directed by Architect. This fence is galvanized, with vinyl coating. Height as indicated on drawings.
   2. Unit of Measure: Linear Foot (LF) of fencing, in place.

G. Item No. 7 - Gypsum Board Ceiling.
   1. Description: Provide additional gypsum board ceiling, in accordance with Section 09 2116 - Gypsum Board Assemblies, in location directed by Architect.
   2. Unit of Measure: Square Foot (SF) of Gypsum Board Ceiling, in place.

H. Item No. 8 - Building Canopy.
   1. Description: Provide new canopy as specified in Section 10 7316 - Canopies, where directed by Architect.
   2. Unit of Measure: Square Foot (SF) of canopy, in place.

I. Item No. 9 - WalkwayCanopy.
   1. Description: Provide new canopy as specified in Section 10 7316 - Canopies, where directed by Architect.
   2. Unit of Measure: Square Foot (SF) of canopy, in place.

J. Item No. 10 - Luxury Vinyl Tile (LVT).
   1. Provide additional luxury vinyl tile flooring, in accordance with Section 09 6813, in location directed by Architect.
   2. Unit of Measure: Square Foot (SF) of LVT, in place.

K. Item No. 11 - ACT-1 Ceiling Tile and Grid:
   1. Description: Provide suspended lay-in ceiling and grid, ACT-1, in accordance with Section 09 5100 - Suspended Acoustical Ceilings, in location directed by Architect.
   2. Unit of Measure: Square Foot (SF) of ceiling, in place.

L. Item No. 12 - ACT-2 Ceiling Tile and Grid:

1. Description: Provide suspended lay-in ceiling and grid, ACT-2, in accordance with Section 09 5100 - Suspended Acoustical Ceilings, in location directed by Architect.
2. Unit of Measure: Square Foot (SF) of ceiling, in place.

M. Item No. 13 - Stamped Concrete
1. Description: Install Stamped Concrete not otherwise shown on drawings, in location directed by Architect.
2. Unit of Measure: Square Foot (SF) of Stamped Concrete, in place.

N. Item No. 14 - 57 Stone
1. Description: Provide additional crushed stone, SCDOT #57 or approved equal, as directed by the Owner's Geotechnical Engineer.
2. Unit of Measure: Ton (TN) of crushed stone in place.

O. Item No. 15 - Access Control
1. Description: Provide Access Control, in location directed by Architect.
2. Unit of Measure: Each (EA).

P. Item No. 16 - Panic Device
1. Provide additional Panic Device, as specified in Section 08 7100.
2. Unit of Measure: Each (EA).

Q. Item No. 17 - Geotextile Fabric for Subgrade Stabilization
1. Provide geotextile fabric, as directed.
2. Unit of Measure: Square Yards (SY) of geotextile fabric in place.

R. Item No. 18 - Dense Grade Base for Subgrade Stabilization
1. Provide dense grade base, as directed.
2. Unit of Measure: Tons (TN) or dense grade base in place.

END OF SECTION

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SECTION 01 2900
PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.03 DEFINITIONS

A. Schedule of Values: A statement acceptable to the Owner and Architect furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.04 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
   1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
      a. Application for Payment forms with Continuation Sheets.
      b. Submittals Schedule.
      c. Contractor’s Construction Schedule.
   2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
   1. Identification: Include the following Project identification on the Schedule of Values:
      a. Project name and location.
      b. Contractor's name and address.
      c. Date of submittal.
   2. Submit draft of Schedule of Values that will accompany Application for Payment.
   3. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
      a. Related Specification Section or Division.
      b. Description of the Work.
      c. Name of subcontractor.
      d. Name of manufacturer or fabricator.
      e. Name of supplier.
      f. Change Orders (numbers) that affect value.
      g. Dollar value.
         1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
   4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate. Include separate line items under required principal subcontracts for operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training in the amount of 5 percent of the Contract Sum.
   5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

6. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.
7. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
9. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
10. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.05 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by approving authority and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Forms: Use Application and Certificate for Payment form stipulated in front-end documents as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Approving authority will return incomplete applications without action.
   1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
   2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
   1. Submit partial waivers on each item for amount requested, before deduction for retainage, on each item.
   2. When an application shows completion of an item, submit final or full waivers.
   3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
   4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of subcontractors.
   2. Schedule of Values, including all values for each allowance.
   3. Contractor's Construction Schedule (preliminary if not final).
   4. Products list.
   5. Schedule of unit prices.
   6. Submittals Schedule (preliminary if not final).
   7. List of Contractor's staff assignments.
   8. List of Contractor's principal consultants.
   9. Copies of building permits.
   10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
   11. Initial progress report.
   12. Report of preconstruction conference.
   13. Certificates of insurance and insurance policies.
   14. Performance and payment bonds.
   15. Data needed to acquire Owner's insurance.
   16. Initial settlement survey and damage report if required.

H. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

I. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
   1. Evidence of completion of Project closeout requirements.
   2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
   3. Updated final statement, accounting for final changes to the Contract Sum.
   4. Contractor's Affidavits of Payment of Debts and Claims, Release of Liens, and Consent of Surety to Final Payment.
   5. Evidence that claims have been settled.
   6. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

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SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electronic document submittal service.

B. Requests For Information.

C. Preconstruction meeting.

D. Progress meetings.

E. Submittals for review, information, and project closeout.

F. Number of copies of submittals.

G. Submittal procedures (Including Submittal Numbering/Tracking Guide and form for Transmittal).

H. Inspections.

1.02 RELATED SECTIONS

A. Section 01 0150 - Special Conditions: Additional Administrative and Submittal Requirements.

B. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.

C. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 PROJECT COORDINATION

A. Project Coordinator: Contractor's Project Manager.

B. Cooperate with the Owner and Architect in allocation of mobilization areas of site; for field offices and sheds, for traffic, and parking facilities.

C. During construction, coordinate use of site and facilities through the Owner and Architect.

D. Comply with Owner and Architect's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

E. Comply with instructions of the Owner and Architect for use of temporary utilities and construction facilities.

F. Coordinate field engineering and layout work under instructions of the Owner and Architect.

G. Make the following types of submittals to Architect:
   1. Schedule of Submittals.
   2. Requests for interpretation.
   3. Requests for substitution.
   4. Shop drawings, product data, and samples.
   5. Test and inspection reports.
   6. Design data.
   7. Manufacturer's instructions and field reports.
   8. Applications for payment and change order requests.
   9. Progress schedules.
   10. Coordination drawings.
   11. Correction Punch List and Final Correction Punch List for Substantial Completion.
   12. Closeout submittals.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
   2. Contractor and Architect are required to use this service.
   3. It is Contractor's responsibility to submit documents in allowable format.
   4. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.
   5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
   6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
   7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
      a. Cost: The cost of the service is to be paid by Contractor; include the cost of the service in the Contract Sum.
         1) Submittal Service: The selected service is:
            (a) Submittal Exchange (tel: 1-800-714-0024): www.submittalexchange.com.
         2) Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.
         3) Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.
      b. Substitutions: Any substitutions of submittal service must be approved by the Architect.

3.02 REQUEST FOR INFORMATION

A. All Pre-Bid Questions, or Requests for Information must be submitted through a prequalified General Contractor via email to the Architect's Project Manager, with a copy to Alyssa Martin (alyssa.martin@gmcnetwork.com). Pre-Bid Questions will be accepted up to 48 hours prior to Bid Opening.

B. Send requests for information (RFI's) to Architect's Project Manager and administrative assistant, following the example form included at the end of this section.

C. Sequentially number the Requests for Information (RFI), and date accordingly.

D. Explanations and interpretations will be issued via Addendum.

E. After award of the Bid, a Request for Information (RFI), when submitted to the Architect, may result in an Architect's Supplemental Instruction (ASI), Request for Proposal (RFP), or Construction Change Directive (CCD) prior to the issuance of a Change Order.

3.03 PRECONSTRUCTION CONFERENCES

A. Prior to commencing any work on the project, a pre-construction conference shall be held. Mandatory attendance will be required of the General Contractor and representative of all

specialty and principal subcontractors involved in the project. Time and date of said conference shall be established by the Architect after award of construction contract.

B. Architect will schedule a meeting after Notice of Award.

C. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.

D. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Designation of personnel representing the parties to Contract, and Architect.
   6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Scheduling.
   8. Other items: To be announced.

E. Similarly, prior to commencing any major portion of the Work of the project, preconstruction conferences shall be held. Mandatory attendance will be required of the General Contractor and representative of all specialty and principal subcontractors involved in the individual major portions of project. Time and date of said conferences shall be established by the General Contractor, and the Architect, Owner, and appropriate Consultants shall be advised in writing of times and dates, by the General Contractor.
   1. “Major portion” may be defined as work items for each Subcontractor working on site, and shall include in part, but not be limited to, earthwork, sitework, site utilities, concrete work, masonry, Division 5, roof framing and Division 6, insulation, roofing systems, finishes, specialties, casework, mechanical, plumbing, and electrical.

F. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. The Contractor shall record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made. Emails to Project Team are acceptable.

D. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Contractor's superintendent.
   5. Major subcontractors.

E. Agenda:
   1. Review minutes of previous meetings.
   2. Review of work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.

6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to work.

3.05 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to Architect, using the submittal numbering tracking system, for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.06 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner. No action will be taken.

3.07 SUBMITTALS FOR PROJECT CLOSEOUT

A. When the following are specified in individual sections, submit them at project closeout in conformance to requirements of Section 01 7800 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.
   6. Submit for Owner's benefit during and after project completion.

3.08 NUMBER OF COPIES OF SUBMITTALS (WHEN ELECTRONIC DOCUMENT SUBMITTAL SERVICE IS USED)

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Documents for Project Closeout: Make one reproduction of submittal originally reviewed. Submit one extra of submittals for information.

C. Samples: Submit no less than 3-each of any sample or color chart which is required or otherwise requested, unless more are required in individual specification sections; one of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

D. Refer to Section 01 0150 - "Special Conditions" for additional information and requirements.

3.09 SUBMITTAL PROCEDURES

A. Transmit each submittal with approved form.

B. Transmit each submittal. Sequentially number each transmittal form according to the example shown on the sample Transmittal form provided at the end of this Section. Include the date, project number and name along with number of copies submitted.

C. Deliver submittals to Architect at business address to the attention of the Contract Administration Coordinator.

D. A Submittal Schedule must be submitted and approved by Architect prior to review of any and all submittals.

3.10 SCHEDULING OF INSPECTIONS

A. Contact the design professional by email of the date the project will be ready for an inspection.

B. The design professional will contact the Local Building Inspector to schedule the first available date for the inspection. Inspections must be requested 14 days in advance.

C. After Building Inspector notifies design professional of time of inspection, design professional will notify Contractor, and Owner, copying Building Inspector.

D. Cancellations of any scheduled inspection must be received in writing by email no less than 48 hours prior to the scheduled inspection. The email shall be sent to the Contractor, Building Inspector, and Owner. If an inspection is cancelled, it will be rescheduled subject to Building Inspector's availability.

3.11 MINIMUM REQUIREMENTS FOR REQUIRED INSPECTIONS

A. Use the following minimum requirements to help determine if a project is ready for required inspection:

B. PRE-CONSTRUCTION CONFERENCE.
   1. Required Attendees: Contractor, Owner, Architect, Major Subcontractors.
   2. Inspection Requirements:
      a. Signed construction contract.
      b. Verification of payment of permit fee.
      c. Contractor's Statement of Responsibility and Quality Assurance Plan (for storm shelter).
      d. Fire Alarm Contractor's Certification (from State Fire Marshall).
      e. ADEM permit, if more than 1 acre of land is disturbed.
   3. PRE-ROOFING CONFERENCE.
      a. Required Attendees: Contractor, Owner, Architect, Roofing Subcontractor, Roofing Manufacturer's Representative.
      b. Inspection Requirements:
      c. Roofing submittals must be approved by Architect prior to pre-roofing conference.
      d. Roofing manufacturer must provide documentation that roof design and roofing materials meet code requirements for wind uplift and impact resistance.
      e. Copy of sample roofing warranty.

C. ABOVE-CEILING INSPECTION.
   1. Required Attendees: Contractor, Owner, Architect, MEP Engineers, Major Subcontractors.
   2. Inspection Requirements:
      a. All work must be completed except for installation of ceiling tiles and/or hard ceilings.

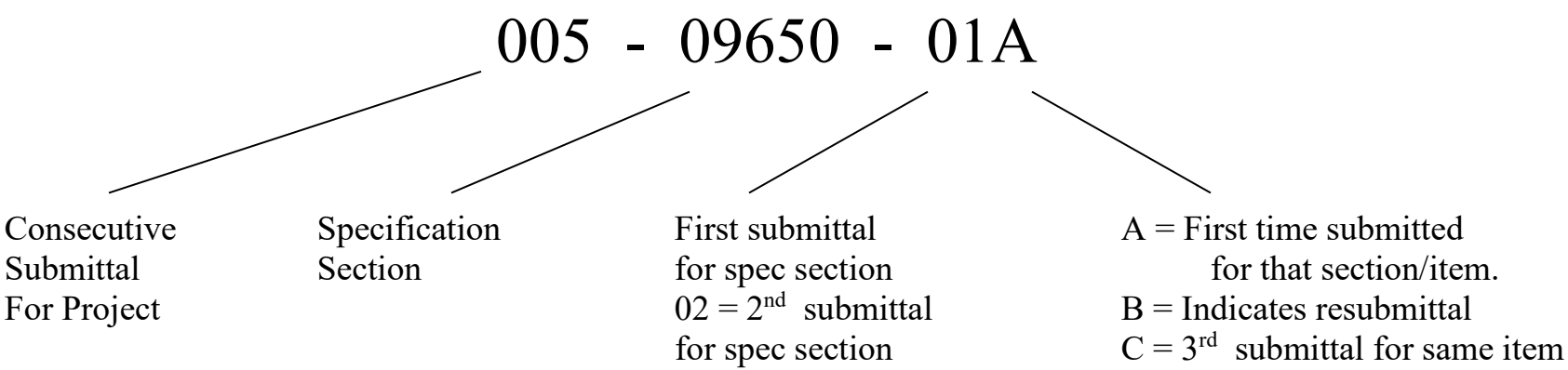
b. Space must be conditioned.
c. Permanent power must be connected unless otherwise arranged with the BC Inspector.
d. Grease duct must be inspected and approved by the BC Inspector prior to fire wrapping and Above-Ceiling Inspection.

D. LIFE SAFETY INSPECTIONS AND FINAL INSPECTIONS.
1. Required Attendees: Contractor, Owner, Architect, Engineers, Major Subcontractors, Local Fire Marshall.
2. Inspection Requirements:
a. Fire alarm certification.
b. Kitchen hood fire suppression system certification.
c. General Contractor's 5-Year Roofing Warranty (ABC Form C-9).
d. Roofing manufacturer's guaranty.
e. Above ground and below ground sprinkler certifications.
f. Completed Certificate of Structural Engineers Observations for storm shelters.
g. Emergency and exit lighting tests.
h. Fire alarm must be monitored.
i. Elevator Inspection completed and Certificate of Operation provided by the State of Alabama Department of Labor.
j. Boiler/Vessels Inspection completed and Certificate of Operation provided by the State of Alabama Department of Labor.
k. Flush test for underground sprinkler lines (witnessed by local fire marshall, fire chief and/or BC Inspector).
l. Flush/pressure test for new and/or existing fire hydrants.
m. Must have clear egress/access and emergency (for first responders) access to building.
n. Must have ADA access completed.

E. YEAR-END INSPECTIONS.
1. Required Attendees: Contractor, Owner, Architect, Engineers and/or Major subcontractors may also be required to attend.
2. Inspection Requirements:
3. Owner's list of documented warranty items.

END OF SECTION

SUBMITTAL NUMBERING / TRACKING



***

INCLUDE ARCHITECT'S PROJECT NUMBER ON ALL SUBMITTAL TRANSMITTALS

**** Architect's Project No. & Name: ABHM250019 HOUSTON COUNTY DEPARTMENT OF HUMAN RESOURCES**
Dothan, Alabama

REQUEST FOR INFORMATION

RFI No. _____

DATE: _____ PROJECT NAME: _____

GM&C PROJECT No._____

FROM: _____ PROJECT MANAGER: _____

_____ GOODWYN MILLS CAWOOD, LLC.

_____ 2400 Fifth Avenue South, Suite 200

_____ Birmingham, AL 35233

REQUEST:

SIGNATURE: _____

SUGGESTION:

RESPONSE: ROUTING:_____ DATE REC'D: _____

SIGNATURE: _____ DATE RET'D: _____

DISTRIBUTION: O Contract Administrator O Consultant O _____ O _____ O _____

*** SEND THIS FORM TO THE CONTRACT ADMINISTRATION COORDINATOR ***

TRANSMITTAL

No. _____

DATE: _____

FROM: _____

_____

_____

_____

PROJECT: _____

GM&C PROJECT No. _____

PROJECT MANAGER: _____

GOODWYN MILLS CAWOOD, LLC.

2400 Fifth Avenue South, Suite 200

Birmingham, AL 35233

Shop Drawing / Submittal No. (see example below) Description

Copies	Submittal Number	Description

RESPONSE: ROUTING: _____ DATE REC'D: _____

SIGNATURE: _____ DATE RET'D: _____

Shop Drawing / Submittal Number Example 005 - 09650 - 01A

- 005 — Consecutive submittal for Project
- 09650 — Specification Section
- 01 — First submittal for spec section; 02 = 2nd submittal for spec section
- A = First time submitted for that section/item.
  B = Indicates resubmittal
  C = Third submittal for same item

*** SEND THIS FORM TO THE CONTRACT ADMINISTRATION COORDINATOR ***

SECTION 01 3216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, with network analysis diagrams and reports.

1.02 REFERENCE STANDARDS

A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.

B. M-H (CPM) - CPM in Construction Management - Project Management with CPM; 2016, with Addendum (2021).

1.03 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Submit updated schedule with each Application for Payment.

D. Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Architect.

1.04 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.05 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Diagram Sheet Size: Maximum 22 x 17 inches (560 x 432 mm).

C. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a preliminary network diagram.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Provide sub-schedules to define critical portions of the entire schedule.

E. Include conferences and meetings in schedule.

F. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

G. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.

H. Indicate delivery dates for owner-furnished products.

I. Provide legend for symbols and abbreviations used.

J. Show total float for each construction activity.

3.03 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.04 NETWORK ANALYSIS

A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.

B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.

C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
   1. Preceding and following event numbers.
   2. Activity description.
   3. Estimated duration of activity, in maximum 15 day intervals.
   4. Earliest start date.
   5. Earliest finish date.
   6. Actual start date.
   7. Actual finish date.
   8. Latest start date.
   9. Latest finish date.
   10. Total and free float; float time shall accrue to Owner and to Owner's benefit.
   11. Monetary value of activity, keyed to Schedule of Values.
   12. Percentage of activity completed.
   13. Responsibility.

D. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, accepting revised completion dates, and recomputation of all dates and float.

E. Required Reports: List activities in sorts or groups:
   1. By preceding work item or event number from lowest to highest.
   2. By amount of float, then in order of early start.
   3. By responsibility in order of earliest possible start date.
   4. In order of latest allowable start dates.
   5. In order of latest allowable finish dates.
   6. Contractor's periodic payment request sorted by Schedule of Values listings.
   7. Listing of basic input data that generates the report.
   8. Listing of activities on the critical path.

3.05 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.06 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.

3.07 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION

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SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. Testing and inspection agencies and services.

D. Control of installation.

E. Mock-ups.

F. Tolerances.

G. Manufacturers' field services.

H. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures.

B. Section 01 4223 - Reference Standards and Definitions.

C. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.03 DEFINITIONS

A. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

1.04 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2023).

B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2026.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2025.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025b.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2026.

G. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2025.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: For integrated exterior and interior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
   1. Indicate manufacturer and model number of individual components.
   2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions
   3. Fire Protection: Sprinkler shop drawings shall include PE stamp of Professional Engineer licensed in the state in which the project is located.

C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

D. Schedule of Submittals.

E. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

F. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Entity responsible for performing tests and inspections.
   3. Description of test and inspection.
   4. Identification of applicable standards.
   5. Identification of test and inspection methods.
   6. Number of tests and inspections required.
   7. Time schedule or time span for tests and inspections.
   8. Requirements for obtaining samples.
   9. Unique characteristics of each quality-control service.

G. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test/inspection.
      h. Date of test/inspection.
      i. Results of test/inspection.
      j. Compliance with Contract Documents.
      k. When requested by Architect, provide interpretation of results.
   2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

H. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
   1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

I. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

J. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

K. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
   2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications:
   1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
   3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.

1.07 TESTING AND INSPECTION AGENCIES AND SERVICES

A. As indicated in individual specification sections, Owner or Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

C. Contractor Employed Agency:
   1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
   2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
   3. Laboratory: Authorized to operate in the State in which the Project is located.
   4. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
   5. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

D. Refer to Section 01 0150 - "Special Conditions" for additional information and requirements.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

D. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

E. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
   2. Make corrections as necessary until Architect's approval is issued.

F. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

G. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

H. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
   3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
   4. Demonstrate the proposed range of aesthetic effects and workmanship.
   5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
      a. Allow seven days for initial review and each re-review of each mockup.
   6. Build mock-up in the following 3 phases (minimum). Obtain approval of each phase from Architect before proceeding.
      a. Substrate construction, and waterproofing.
      b. Opening installation, and flashing.
      c. Veneer. (Divide this into multiple phases of mock-up if there are multiple layers.)
   7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   8. Protect mock-ups from the elements with weather-resistant membrane.
   9. Demolish and remove mockups when directed unless otherwise indicated.

I. Integrated Exterior Mockups: Construct integrated exterior mockup as indicated on Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

J. Room Mockups: Construct room mockups incorporating required materials and assemblies, finished according to requirements. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work. See Drawings for any required Room Mockups.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

A. See individual specification sections for testing required.

B. Testing Agency Duties:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   6. Perform additional tests and inspections required by Architect.
   7. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect. Payment for re-testing will be charged to the Contractor by deducting testing charges from the Contract Price.

F. Refer to Section 01 0150 - "Special Conditions" for additional information and requirements.

3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of

surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

END OF SECTION

SECTION 01 4100

STRUCTURAL TESTS AND SPECIAL INSPECTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements required for compliance with the International Building Code, Chapter 17, Structural Tests and Special Inspections.

B. Structural testing and special inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve contractor of responsibility for compliance with other construction document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the construction document requirements.
3. Requirements for contractor to provide quality-assurance and -control services required by architect, owner, or authorities having jurisdiction are not limited by provisions of this section.

C. The owner will engage one or more qualified special inspectors and / or testing agencies to conduct structural tests and special inspections specified in this section and related sections and as maybe specified in other divisions of these specifications.

D. Related Sections include but are not limited to the following:

1. Section 0 22000 - “Earthwork”
2. Section 03 3100 - “Cast-In-Place Concrete”
3. Section 05 1200 - “Structural Steel”
4. Section 05 3100 - “Steel Deck”
5. Section 05 4500 – “Light Gauge Steel Trusses”

1.3 DEFINITIONS

A. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by the building official.

B. Construction Documents: Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit. Construction Documents include all supplemental instructions, sketches, addenda, and revisions to the drawings and specifications issued by the registered design professional beyond those issued for a building permit.

C. Shop Drawings / Submittal Data: Written, graphic and pictorial documents prepared and / or assembled by the contractor based on the Construction Documents.

D. Structural Observation: Visual observation of the structural system by a representative of the registered design professional's office for general conformance to the approved construction documents. Structural observations are not considered part of the structural tests and special inspections and do not replace inspections and testing by the testing agency or special inspector.

E. Special Inspector: A qualified person who demonstrating competence, to the satisfaction of the code enforcement official and registered design professional in responsible charge, for inspection of the particular type of construction or operation requiring special inspection. The special inspector shall be a licensed professional engineer or engineering intern or a qualified representative from the testing agency.

F. Special Inspection, Continuous: The full-time observation of work requiring special inspection by an approved special inspector who is present in the area where the work is being performed.

G. Special Inspection, Periodic: The part-time or intermittent observation of work requiring special inspection by an approved special inspector who is present in the area where the work has been or is being performed and at the completion of the work.

H. Testing Agency: A qualified materials testing laboratory under the responsible charge of a licensed professional engineer, approved by the code enforcement official and the registered design professional in responsible charge, to measure, examine, test, calibrate, or otherwise determine the characteristics or performance of construction materials and verify confirmation with construction documents.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Minimum qualifications of inspection and testing agencies and their personnel shall comply with ASTM E329-03 Standard Specification for Agencies in the Testing and / or Inspection of Materials Used in Construction.

    a. Inspectors and individuals performing tests shall be certified for the work being performed as outlined in the appendix of the ASTM E329. Certification by organizations other than those listed must be submitted to the building official for consideration before proceeding with work.

2. In addition to these requirements, local jurisdiction may have additional requirements. It is the responsibility of the testing and inspection agencies to meet local requirements and comply with local procedures.

B. Qualifications of Special Inspector: The Special Inspector shall be a qualified person who shall demonstrate competence, to the satisfaction of the Building Official, for inspection of the particular type of construction or operation being inspected. The Special Inspector shall meet the legal qualifications of the building code having jurisdiction.

1. Duties and Responsibilities of the Special Inspector:

a. The Special Inspector shall observe the work assigned to ascertain, to the best of his/her knowledge that it is in conformance with the approved design drawings and specifications.

b. The Special Inspector shall furnish inspection reports to the Building Official, the Architect/Engineer, and the Owner. All discrepancies shall be brought to the immediate attention of the Architect/Engineer, Contractor, and Owner. A report that the corrected work has been inspected shall be sent to the Building Official, the Architect/Engineer, and the Owner.

c. The Special Inspector shall create and maintain a log of all discrepancies throughout the duration of the project. This log shall include, but is not limited to, discrepancy date, description, drawing and/or detail reference, description of as-built condition, description of any remedial work performed, and status of discrepancy. This log shall be submitted to the Architect/Engineer on a periodic basis for the review and comment. Upon completion of the project, this log shall be submitted in its entirety as an attachment to the final signed report described below.

d. The Special Inspector shall submit a final signed report stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance to the approved plans and specifications and the applicable workmanship provisions of the building code.

1.5 CONFLICTING REQUIREMENTS, REPORTS, AND TEST RESULTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the registered design professional in responsible charge for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to the registered design profession in responsible charge for a decision before proceeding.

C. The special inspector's reports and testing agencies results shall have precedence over reports and test results provided by the contractor.

D. Where a conflict exists between the construction documents and approved shop drawings / submittal data, the construction documents shall govern unless the shop drawings / submittal data are more restrictive. All conflicts shall be brought to the attention of the registered design professional in responsible charge.

1.6 SUBMITTALS BY SPECIAL INSPECTOR AND / OR TESTING AGENCY

A. Special inspectors shall keep and distribute records of inspections. The special inspector shall furnish inspection reports to the building official, and to the registered design professional in responsible charge, contractor, architect, and owner. Reports shall indicate that work inspected was done in conformance to approved construction documents. Discrepancies shall be brought to the immediate attention of the contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the building official and to the registered design professional in

responsible charge prior to the completion of that phase of the work. A final report documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted at a point in time agreed upon by the permit applicant and the building official prior to the start of work.

1. Special inspection reports and test results shall include, but not be limited to, the following:

    a. Date of inspection.
    b. Description of inspections or tests performed including location (reference grid lines, floors, elevations, etc.).
    c. Statement noting that the work, material, and / or product conforms or does not conform to the construction document requirements.

        1) Name and signature of contractor's representative who was notified of work, material, and / or products that do not meet the construction document requirements.

    d. Name and signature of special inspector and / or testing agency representative performing the work.

B. Schedule of Non-Compliant Work: Each agent shall maintain a log of work that does not meet the requirements of the construction documents. Include reference to original inspection / test report and subsequent dates of re-inspection / retesting.

C. Reports and tests shall be submitted within 1 week of inspection or test. Schedule of Non-Compliant Work shall be updated daily and submitted at monthly intervals.

D. Final Report of Special Inspections. Submitted by each agent listed in the schedule of Structural Testing and Special Inspections.

1.7 PAYMENT OF TESTING LABORATORY

A. The Owner will pay for the initial laboratory services for the testing of materials for compliance with the requirements of the contract documents. The Contractor will be liable to the Owner for the cost for testing and retesting of materials that do not comply with the requirements of the contract documents and shall furnish and pay for the testing and inspection of other items as specified in these Specifications.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.1 CONTRACTOR'S RESPONSIBILITY

A. The contractor shall coordinate the inspection and testing services with the progress of the work. The contractor shall provide sufficient notice to allow proper scheduling of all personnel. The contractor shall provide safe access for performing inspection and on site testing.

B. The contractor shall submit schedules to the owner, registered design professionals and testing and inspecting agencies. Schedules will note milestones and durations of time for materials requiring structural tests and special inspections.

C. The contractor shall repair and / or replace work that does not meet the requirements of the construction documents.

1. Contractor shall engage an engineer / architect to prepare repair and / or replacement procedures.
2. Engineer / architect shall be registered in the state in which the project is located. Engineer shall be acceptable to the registered design professional in responsible charge, code enforcement official, and owner.
3. Procedures shall be submitted for review and acceptance by the registered design professional in responsible charge, code enforcement official, and owner before proceeding with corrective action.

D. The contractor shall be responsible for costs of:

1. Re-testing and re-inspection of materials, work, and / or products that do not meet the requirements of the construction documents and shop drawings / submittal data.
2. Review of proposed repair and / or replacement procedures by the registered design professional in responsible charge and the inspectors and testing agencies.
3. Repair or replacement of work that does not meet the requirements of the construction documents.

3.2 STRUCTURAL OBSERVATIONS

A. Structural observations may be made periodically as determined by the registered design professional in responsible charge.

3.3 TESTING AND INSPECTION

A. Testing and inspection shall be in accordance with the attached Schedule of Special Inspections.

B. Reference related specifications for the minimum level of inspections and testing. Provide additional inspections and testing as necessary to determine compliance with the construction drawings.

3.4 SCHEDULES AND FORMS – ATTACHED OR IN CONSTRUCTION DOCUMENTS

A. STATEMENT OF SPECIAL INSPECTIONS

B. SCHEDULE OF SPECIAL INSPECTIONS (ON STRUCTURAL DRAWINGS)

C. FINAL REPORT OF SPECIAL INSPECTIONS

END OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

STATEMENT OF SPECIAL INSPECTIONS

Project:
Project Address:
Permit Applicant:
Applicant Address:
Owner:
Owner Address:

Registered Design Professionals (RDP):

Architect:
Geotechnical Engineer:
Structural Engineer:
Mechanical Engineer:
Electrical Engineer:

This statement of special inspections is submitted as a condition for permit issuance in accordance with Chapter 17 of the International Building Code. It includes a *Schedule of Special Inspections* applicable to the above referenced project as well as the identity of the individuals, agencies, or firms intended to be retained for conducting these inspections.

The Special Inspector(s) shall keep records of all inspections and shall furnish interim inspection reports to the building official and to the registered design professional in responsible charge at a frequency agreed upon by the permit applicant and building official prior to the start of work. Discrepancies shall be brought to the immediate attention of the contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the building official and the registered design professional in responsible charge prior to completion of that phase of work. A *Final Report of Special Inspections* documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted by each agent at the completion of that phase of work.

Maximum frequency of interim report submittals shall not be less than_____.

The Special Inspection program does not relieve the contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Owner's Acknowledgement:

_____
Signature Date

Building Official's Acceptance:

_____
Signature Date

_____
Permit No.

FINAL REPORT OF SPECIAL INSPECTIONS

Project:
Project Address:
Testing / Inspection Agent:
Testing / Inspection Agent Address:
Scope of Testing / Inspections:

(To be completed by Testing / Inspection Agent)

To the best of my information, knowledge, and belief, the special inspections or testing required for this project, and designated for this Agent in the *Schedule of Special Inspections* submitted for permit, have been completed in accordance with the contract documents.

Interim reports submitted prior to this final report and numbered _____ to _____ form a basis for, and are to be considered an integral part of this final report. The following discrepancies that were outstanding since the last interim report dated have been corrected:

_____

_____

(Attach 8 1/2" x 11" continuation sheet(s) if required to complete the description of corrections)

Prepared By:

_____
Type or print name

_____
Signature Date

Special Inspector's Seal

(Licensed Professional Engineer)

SECTION 01 4216
DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

A. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

A. Furnish: To supply, deliver, unload, and inspect for damage.

B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

D. Provide: To furnish and install.

E. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 4219
REFERENCE STANDARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements relating to referenced standards.

B. Reference standards full title and edition date.

1.02 QUALITY ASSURANCE

A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.

C. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Architect shall be altered by Contract Documents by mention or inference otherwise in any reference document.

PART 2 CONSTRUCTION INDUSTRY ORGANIZATION DOCUMENTS

2.01 AA -- ALUMINUM ASSOCIATION, INC.

2.02 AAMA -- AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION

A. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2025.

B. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2024.

C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

D. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2026.

2.03 ACI -- AMERICAN CONCRETE INSTITUTE INTERNATIONAL

A. ACI 301 - Specifications for Concrete Construction; 2020.

B. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.

C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).

D. ACI 305R - Guide to Hot Weather Concreting; 2020.

E. ACI 306R - Guide to Cold Weather Concreting; 2016.

F. ACI 318 - Building Code Requirements for Structural Concrete; 2019 (Reapproved 2022).

G. ACI 347R - Guide to Formwork for Concrete; 2014 (Reapproved 2021).

2.04 ADC -- AIR DIFFUSION COUNCIL

A. ADC 1062: GRD - Test Code for Grilles, Registers & Diffusers; 1984.

2.05 AHRI -- AIR-CONDITIONING, HEATING, AND REFRIGERATION INSTITUTE

A. AHRI 430 (I-P) - Standard for Performance Rating of Central Station Air-handling Unit Supply Fans; 2020.

2.06 AISC -- AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC.

2.07 AISI -- AMERICAN IRON AND STEEL INSTITUTE

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data; 2017.

C. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.

D. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2020.

2.08 AMCA -- AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.

B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.

C. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2021, with Editorial Revision (2022).

2.09 ANSI -- AMERICAN NATIONAL STANDARDS INSTITUTE

A. ANSI 117 - Standard Specification for Structural Glued Laminated Timber of Softwood Species; 2025.

B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.

C. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2020.

D. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs; 2020.

E. ANSI A250.4 - American National Standard Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings.; 2011.

F. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames.; 2003.

G. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.; 1998 (R2011).

H. ANSI/AHIA Z60.1 - American National Standard for Nursery Stock; 2014.

2.10 ARI -- AIR-CONDITIONING AND REFRIGERATION INSTITUTE (SEE AHRI)

2.11 ASCE -- AMERICAN SOCIETY OF CIVIL ENGINEERS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

2.12 ASHRAE -- AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.

A. ASHRAE Std 20 - Methods of Laboratory Testing Remote Mechanical-Draft Air-Cooled Refrigerant Condensers; 2019.

B. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ASHRAE Std 90.1 I-P-2013 - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013.

2.13 ASME -- THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

C. ASME B31.9 - Building Services Piping; 2025.

2.14 ASTM A SERIES -- ASTM INTERNATIONAL

A. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2026.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

G. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.

H. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength; 2014a.

I. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

J. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2026.

K. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019 (Reapproved 2025).

L. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

M. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

N. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2024.

O. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2022.

P. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2025.

Q. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2026.

R. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

S. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.

2.15 ASTM B SERIES -- ASTM INTERNATIONAL

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

B. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2023.

C. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2022.

D. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products; 2025.

2.16 ASTM C SERIES -- ASTM INTERNATIONAL

A. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.

B. ASTM C90 - Standard Specification for Dry-Cast Loadbearing Concrete Masonry Units; 2024a.

C. ASTM C91/C91M - Standard Specification for Masonry Cement; 2025.

D. ASTM C129 - Standard Specification for Dry-Cast Nonloadbearing Concrete Masonry Units; 2025.

E. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2026.

F. ASTM C143/C143M - Standard Test Method for Slump of Concrete; 2026a.

G. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2025.

H. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.

I. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2024.

J. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2024.

K. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2025b.

L. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2024.

M. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).

N. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

O. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2024.

P. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2026).

Q. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

R. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

S. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019 (Reapproved 2025).

T. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

U. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

V. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2025a.

W. ASTM C836/C836M - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course; 2018 (Reapproved 2022).

X. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2025.

Y. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).

Z. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

AA. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

BB. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2024.

CC. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

DD. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).

EE. ASTM C1036 - Standard Specification for Flat Glass; 2025.

FF. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

GG. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.

HH. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength; 2022.

II. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2024, with Editorial Revision (2025).

JJ. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.

KK. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2024.

LL. ASTM C1186 - Standard Specification for Flat Fiber-Cement Sheets; 2022, with Editorial Revision (2023).

MM. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.

NN. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2025.

OO. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2024.

PP. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2025.

QQ. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.

RR. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.

2.17 ASTM D SERIES -- ASTM INTERNATIONAL

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.

B. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2025.

C. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.

D. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2024.

E. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2024).

F. ASTM D3161/D3161M - Standard Test Method for Wind Resistance of Steep Slope Roofing Products (Fan-Induced Method); 2020 (Reapproved 2025).

G. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement; 2025.

H. ASTM D4869/D4869M - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing; 2016a (Reapproved 2025).

2.18 ASTM E SERIES -- ASTM INTERNATIONAL

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

B. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

C. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2026.

D. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2026.

E. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

F. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

G. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

H. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2020.

I. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2024a.

J. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

K. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).

L. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2024.

M. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2024.

N. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

O. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.

P. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-Story Test Apparatus; 2025b.

2.19 ASTM F SERIES -- ASTM INTERNATIONAL

A. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact; 2017 (Reapproved 2023).

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2025.

D. ASTM F1292 - Standard Specification for Impact Attenuation of Surfacing Materials Within the Use Zone of Playground Equipment; 2022.

E. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples; 2021.

F. ASTM F1700 - Standard Specification for Solid Vinyl Floor in Modular Format such as Tile(s) or Plank(s); 2025.

G. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021 (Reapproved 2025).

2.20 AWI/AWMAC/WI -- JOINT PUBLICATION OF ARCHITECTURAL WOODWORK INSTITUTE/ARCHITECTURAL WOODWORK MANUFACTURERS ASSOCIATION OF CANADA/WOODWORK INSTITUTE

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

2.21 AWMAC/WI -- JOINT PUBLICATION OF ARCHITECTURAL WOODWORK MANUFACTURERS ASSOCIATION OF CANADA/WOODWORK INSTITUTE

A. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

2.22 AWPA -- AMERICAN WOOD-PRESERVERS' ASSOCIATION

A. AWPA U1 - Use Category System: User Specification for Treated Wood; 2025.

2.23 AWS -- AMERICAN WELDING SOCIETY

A. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

B. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

C. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).

D. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2025, with Errata (2026).

2.24 AWWA -- AMERICAN WATER WORKS ASSOCIATION

A. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2023.

2.25 BHMA -- BUILDERS HARDWARE MANUFACTURERS ASSOCIATION

A. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.

2.26 BIA -- BRICK INDUSTRY ASSOCIATION

A. BIA Technical Notes No. 28B - Brick Veneer/Cold-Formed Steel Framed Walls; 2025.

A. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.

B. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.

C. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.

2.27 CDA -- COPPER DEVELOPMENT ASSOCIATION, INC.

A. CDA A4050 - Copper in Architecture - Handbook; Current Edition.

2.28 DHI -- DOOR AND HARDWARE INSTITUTE

2.29 FM -- FACTORY MUTUAL GLOBAL

A. FM (AG) - FM Approval Guide; Current Edition.

2.30 GA -- GYPSUM ASSOCIATION

A. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

B. GA-600 - Fire Resistance and Sound Control Design Manual; 2024.

2.31 GANA -- GLASS ASSOCIATION OF NORTH AMERICA

A. GANA (GM) - GANA Glazing Manual; 2022.

B. GANA (SM) - GANA Sealant Manual; 2008.

2.32 HPVA -- HARDWOOD PLYWOOD VENEER ASSOCIATION

A. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2024.

2.33 ICC -- INTERNATIONAL CODE COUNCIL, INC.

A. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. ICC (IFC) - International Fire Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

A. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

2.34 ITS -- INTERTEK TESTING SERVICES NA, INC.

A. ITS (DIR) - Directory of Listed Products; Current Edition.

2.35 MPI -- MASTER PAINTERS INSTITUTE (MASTER PAINTERS AND DECORATORS ASSOCIATION)

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

2.36 NAAMM -- THE NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS

A. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

B. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2024.

C. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

2.37 NEMA -- NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

A. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

B. NEMA MG 1 - Motors and Generators; 2021.

2.38 NFPA -- NATIONAL FIRE PROTECTION ASSOCIATION

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2026.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; 2024.

D. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection; 2025.

E. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances; 2025.

F. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems; 2026, with Amendment (2025).

G. NFPA 30 - Flammable and Combustible Liquids Code; 2024, with Errata (2025).

H. NFPA 54 - National Fuel Gas Code; 2024.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

K. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025, with Amendment (2024).

L. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

M. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

N. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

P. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

Q. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; 2006.

R. NFPA 2001 - Standard on Clean Agent Fire Extinguishing Systems; 2025.

2.39 NRCA -- NATIONAL ROOFING CONTRACTORS ASSOCIATION

A. NRCA (RM) - The NRCA Roofing Manual; 2026.

2.40 RIS -- REDWOOD INSPECTION SERVICE

A. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber; 2019.

2.41 SDI -- STEEL DOOR INSTITUTE

A. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.

2.42 SMACNA -- SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC.

A. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

2.43 SPIB -- SOUTHERN PINE INSPECTION BUREAU, INC.

A. SPIB (GR) - Standard Grading Rules; 2021.

2.44 SSPC -- SOCIETY FOR PROTECTIVE COATINGS

A. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

B. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

C. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

D. SSPC-SP 2 - Hand Tool Cleaning; 2024.

E. SSPC-SP 11 - Power-Tool Cleaning to Bare Metal; 2020.

2.45 TCNA -- TILE COUNCIL OF NORTH AMERICA, INC.

A. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2025-2026.

A. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.

2.46 TMS -- THE MASONRY SOCIETY

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

2.47 UL -- UNDERWRITERS LABORATORIES INC.

A. UL (DIR) - Online Certifications Directory; Current Edition.

B. UL (EAUED) - Electrical Appliance and Utilization Equipment Directory; current edition.

C. UL (FRD) - Fire Resistance Directory; Current Edition.

D. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

E. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

F. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems; Current Edition, Including All Revisions.

G. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

I. UL 864 - Control Units and Accessories for Fire Alarm Systems; Current Edition, Including All Revisions.

J. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

K. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

2.48 WCLIB -- WEST COAST LUMBER INSPECTION BUREAU

A. WCLIB (GR) - WCLB Standard Grading Rules for West Coast & Imported Softwood Lumber No.18; 2024.

2.49 WWPA -- WESTERN WOOD PRODUCTS ASSOCIATION

A. WWPA G-5 - Western Lumber Grading Rules; 2025.

PART 3 UNITED STATES GOVERNMENT AND RELATED AGENCIES DOCUMENTS

3.01 CFR -- CODE OF FEDERAL REGULATIONS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

C. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

D. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

3.02 PS -- PRODUCT STANDARDS

A. PS 20 - American Softwood Lumber Standard; 2025.

END OF SECTION

SECTION 01 4533
CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Code-required special inspections.

B. Testing services incidental to special inspections.

C. Submittals.

1.02 DEFINITIONS

A. Code or Building Code: ICC (IBC), International Building Code, most recent edition adopted by authority having jurisdiction, including all applicable amendments and supplements without limitation, and specifically Chapter 17 - Special Inspections and Tests.

B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.

C. Special Inspections and Tests: Inspections and testing of materials, installation, fabrication, erection, or placement of components and connections mandated by Building Code to safeguard public welfare.
   1. Special inspections and tests are separate from and independent of tests and inspections conducted by Owner or Contractor for purposes of quality assurance and contract administration.

1.03 REFERENCE STANDARDS

A. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025b.

B. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2025.

C. IAS AC291 - Accreditation Criteria for Special Inspection Agencies AC291; 2025, with Editorial Revision.

D. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Fabricator's Qualification Statement: When required by AHJ, submit documentation of fabrication facilities and methods and quality control procedures. Include documentation of AHJ approval.

C. Special Inspection Reports: After each special inspection, Special Inspector is required to submit at least two copies of report; one to Architect and one to AHJ.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of Special Inspector.
      d. Date and time of special inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of special inspection.
      h. Date of special inspection.
      i. Results of special inspection.
      j. Compliance with contract documents.
   2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.

D. Test Reports: After each test or inspection, Testing Agency is required to submit report to Architect and to AHJ.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test or inspection.
      h. Date of test or inspection.
      i. Results of test or inspection.
      j. Compliance with contract documents.

1.05 SPECIAL INSPECTION AND TESTING AGENCY

A. Owner or Architect to employ services of Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by building code.

B. Special Inspection Agency may delegate to independent testing agency to perform testing and sampling associated with special inspections and required by building code.

C. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of contract documents.

1.06 TESTING AND INSPECTION AGENCIES

A. Owner or Architect may employ services of independent testing agency to perform additional testing and sampling required by contract documents or associated with special inspections but not required by building code.

B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of contract documents.

1.07 QUALITY ASSURANCE

A. Special Inspection Agency Qualifications:
   1. Independent firm specializing in performing testing and inspections of the type specified in this section.
   2. Accredited by IAS according to IAS AC291.

B. Testing Agency Qualifications:
   1. Independent firm specializing in performing testing and inspections of the type specified in this section.
   2. Accredited by IAS according to IAS AC89.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

A. The Code requires special inspections and testing of certain materials, components, assemblies, and connections used in constructing the project. Special inspections and testing will be performed in accordance with the Code.

B. Special inspections and testing will be performed in accordance with the Code for the following materials and project components:
   1. Concrete.
   2. Masonry.
   3. Wood.
   4. Soils.
   5. Driven deep foundations.
   6. Cast-in-place deep foundations.
   7. Helical pile foundations.

8. Vertical masonry foundation elements.
9. Sprayed fire-resistant materials.
10. Mastic and intumescent fire-resistant coatings.
11. Exterior insulation and finish systems (EIFS).
12. Fire-resistant penetrations and joints.
13. Smoke control testing.
14. Seismic resistance.
15. Wind resistance.

3.02 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

A. Special Inspection Agency shall:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified reference standards.
   3. Ascertain compliance of materials and products with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests or inspections specified.

B. Limits on Special Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the work.

C. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

D. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.03 TESTING AGENCY DUTIES AND RESPONSIBILITIES

A. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests or inspections specified.

B. Limits on Testing or Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the work.

C. On instructions by Architect, perform re-testing required because of non-compliance with specified requirements, using the same agency.

D. Contractor will pay for re-testing required because of non-compliance with specified requirements.

3.04 CONTRACTOR DUTIES AND RESPONSIBILITIES

A. Contractor Responsibilities, General:
   1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
   2. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to work to be tested or inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
      c. To facilitate tests or inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
   5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

B. Contractor Responsibilities, Seismic Force-Resisting System, Designated Seismic System, and Seismic Force-Resisting Component: Submit written statement of responsibility for each item listed in the Statement of Special Inspections to AHJ and Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.

C. Contractor Responsibilities, Wind Force-Resisting System and Wind Force-Resisting Component: Submit written statement of responsibility for each item listed in the Statement of Special Inspections to AHJ and Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.

END OF SECTION

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary telecommunications services.

C. Temporary sanitary facilities.

D. Temporary Controls: Barriers, enclosures, and fencing.

E. Security requirements.

F. Vehicular access and parking.

G. Waste removal facilities and services.

H. Field offices.

1.02 RELATED REQUIREMENTS

A. Section 01 5813 - Temporary Project Signage.

1.03 TEMPORARY UTILITIES

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

B. Existing facilities may not be used.

1.04 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

B. Telecommunications services shall include:
   1. Telephone Lines: One line, minimum; one handset per line.
   2. Internet Connections: Minimum of one; DSL modem or faster.
   3. Cellular phones are an acceptable substitute for items 1 & 2, provided they fulfill requirements of same.

1.05 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

1.06 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING

A. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular and pedestrian gates with locks. Provide gates as required by Contractor and/or authorities having jurisdiction, with all related safety and warning signs.

B. Fencing shall be at least 11-1/2 gauge galvanized chain-link fencing, securely held in place by posts, braces, rails, etc.

C. Fence shall be approximately 30-feet from perimeter of buildings, unless Drawings indicate otherwise. Extent of fencing shall be as required to maintain a secure worksite.

D. All such fencing shall be removed upon completion of the work of this project, removed from the site, and any post holes filled and compacted same as adjacent grade or paving, by the Contractor.

E. Responsibility and maintenance of such fencing and areas within such fencing shall be held by this Contractor beginning at the date of its erection and until its removal, close to the date of project completion.

1.08 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.09 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner's security program.

1.10 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Designated existing on-site roads may be used for construction traffic.

F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.11 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.12 PROJECT SIGNS - SEE SECTION 01 5813

1.13 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 10 persons.

C. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures.

1.14 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet (600 mm).

C. Clean and repair damage caused by installation or use of temporary work.
D. Restore existing facilities used during construction to original condition.
E. Restore new permanent facilities used during construction to specified condition.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

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SECTION 01 5813
TEMPORARY PROJECT SIGNAGE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Project identification sign.

B. Project informational signs.

1.02 RELATED REQUIREMENTS

A. Section 01 0150 - Special Conditions: Supplemental sign information.

B. Project Sign Detail: Included at the end of this Section.

1.03 REFERENCE STANDARDS

A. FHWA (SHS) - Standard Highway Signs; Federal Highway Administration; 2004.

1.04 QUALITY ASSURANCE

A. Design sign and structure to withstand 50 miles/hr (80 km/hr) wind velocity.

B. Sign Painter: Experienced as a professional sign painter for minimum three years.

C. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawing: Show content, layout, lettering, color, foundation, structure, sizesand grades of members.

PART 2 - PRODUCTS

2.01 SIGN MATERIALS

A. Structure and Framing: New, wood, structurally adequate.

B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4 inch (19 mm) thick, standard large sizes to minimize joints.
   1. See Project Sign Detail for Options.
      a. Rough Hardware: Galvanized.
      b. Paint and Primers: Exterior quality, two coats; sign background of color as selected.
      c. Lettering: Exterior quality paint, colors as selected.
         1) See Project Sign Detail for Options.

2.02 PROJECT IDENTIFICATION SIGN

A. Painted sign of construction, design, and content shown on Project Sign Detail, and described below.
   1. Refer to Detail of Project Sign, following this Section.
   2. Content:
      a. Project number, title, logo and name of Owner as indicated on Contract Documents.
      b. Names and titles of authorities.
      c. Names and titles of Architect.
      d. Name of Contractor.
   3. Graphic Design, Colors, Style of Lettering: Designated by Architect.

2.03 PROJECT INFORMATIONAL SIGNS

A. Painted informational signs of same colors and lettering as Project Identification sign, or standard products; size lettering to provide legibility at 100 foot (30 m) distance.

B. Provide at each field office, storage shed, and directional signs to direct traffic into and within site. Relocate as Work progress requires.

C. Provide municipal traffic agency directional traffic signs to and within site.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install project identification sign within 30 days after date fixed by Notice to Proceed.

B. Erect at location of high public visibility adjacent to main entrance to site.

C. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.

D. Install sign surface plumb and level, with butt joints. Anchor securely.

E. Paint exposed surfaces of sign, supports, and framing.

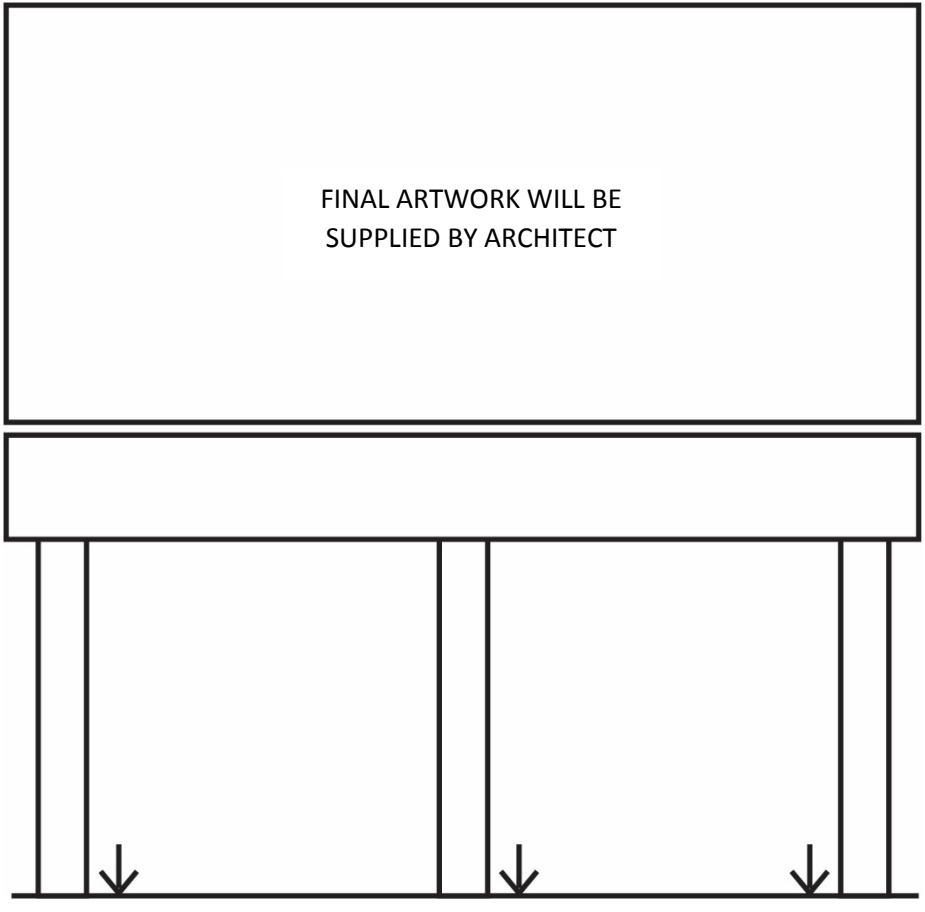
3.02 MAINTENANCE

A. Maintain signs and supports clean, repair deterioration and damage.

3.03 REMOVAL

A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

END OF SECTION



SIGN: 8’ X 4’ SIGN WITH 8’ X 1’ADDITION PRINTED ON ½” THICK COROPLAST OR CORRUGATED ALUMINUM, PRINTED ON FLAT-BED ARIZONA PRINTER OR EQUIVALENT WITH UV INKS IN FULL COLOR. CONTACT ARCHITECT FOR FINAL ARTWORK.

OPTION: PRINT ON EXTERIOR GRADE VINYL WITH UV INKS IN FULL COLOR APPLIED TO 8’ X 4’ X ½” THICK COROPLAST OR CORRUGATED ALUMINUM. CONTACT ARCHITECT FOR FINAL ARTWORK.

WOOD POSTS: P.T. 4 X 4 X FULL HEIGHT OF SIGN, WITH 45˚ TO 60˚ SLOPED P.T. 4 X 4 WOOD BACK BRACES FROM TOP OF SIGN, BRACE BETWEEN POSTS AT TOP & BOTTOM W/FLAT P.T. 2 X 6 OR 4 X 4. SET POSTS 3’- O” MINIMUM INTO GROUND, IN 12” DIAMETER X 3’ - 6” DEEP CONCRETE FOOTINGS.

TOP OF SIGN: 7 FT. TO 8 FT. ABOVE FINISHED GRADE.

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations.

E. Procedures for Owner-supplied products.

F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Instructions To Bidders, and Supplementary Instructions To Bidders: Additional information and requirements concerning Substitutions.

B. Section 01 4000 - Quality Requirements: Product quality monitoring.

1.03 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 - PRODUCTS

2.01 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. DO NOT USE products having any of the following characteristics:
   1. Made of wood from newly cut old growth timber.

C. Where all other criteria are met, Contractor shall give preference to products that:
   1. Are extracted, harvested, and/or manufactured closer to the location of the project.
   2. Have longer documented life span under normal use.
   3. Result in less construction waste.
   4. Are made of vegetable materials that are rapidly renewable.

2.02 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.03 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 - EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. Acceptance of suppliers, manufacturers, and/or products shall be limited to those named, unless others are properly submitted during bidding in accordance with substitution procedures, and subsequently accepted.

B. Instructions to Bidders specifies time restrictions and procedures for submitting requests for substitutions during the bidding period. These time restrictions and procedures are superceded by any modifications found in Supplementary Instructions to Bidders (or Additions to Instructions to Bidders).

C. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
   1. Submittals during construction other than those pre-qualified or pre-accepted will not be reviewed, but instead returned for re-submittal, without exception.

D. Substitution Submittal Procedure. A proper pre-bid submittal for "pre-qualified" or "pre-accepted" consideration and review, shall be one which includes at least the following:
   1. Submit request for substitution for consideration. Limit each request to one proposed substitution.
   2. Use Substitution Request form attached at end of this Section.
   3. Submit with cover letter which outlines the purpose of the submittal, Architect's specifications which apply, and each variation from the original specification.
   4. Submit product data (all current and relevant manufacturer's published data), certified test results attesting to the proposed product equivalence, and additional information as required so that a review can be quickly made by comparing the submittal item for item to the original specification. Include samples and other data as requested for the original item. Burden of proof is on proposer.
   5. Substitution requests shall be submitted through a qualified General Contractor bidding the project.

E. After receipt of bids and execution of the Construction Contract, the Owner and the Architect will consider substitutions only under the following conditions:
   1. Unavailability of materials if beyond the control of the Contractor and submitted proof that firm orders for the material were placed within ten (10) days after approval of the Subcontractors and Material Suppliers Lists.
   2. Other unavailability will be considered only as being due to strikes, lockouts, bankruptcy, or discontinuance of manufacture.
   3. Any approved substitutions shall be incorporated into the Contract by Change Order.

3.02 OWNER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:

1. Review Owner reviewed shop drawings, product data, and samples.
2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide off-site storage and protection when site does not permit on-site storage or protection.

G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

H. Comply with manufacturer's warranty conditions, if any.

I. Do not store products directly on the ground.

J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

K. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

L. Prevent contact with material that may cause corrosion, discoloration, or staining.

M. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

N. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

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SUBSTITUTION REQUEST

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

Attn: _____ A/E Project No.: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page and Paragraph: _____

Proposed Substitution: _____

Trade Name: _____

Manufacturer: _____ Model No.: _____

Mfg. Address _____ City, State, zip: _____ Phone: _____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the date are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____ E-mail: _____

A/E's REVIEW AND ACTION

- ☐ Substitution approved - Make submittals in accordance with Specifications, Substitution Procedures.
- ☐ Substitution approved as noted - Make submittals in accordance with Specifications Substitution Procedures.
- ☐ Substitution rejected - Use specified materials.
- ☐ Substitution Request received too late - Use specified materials.

Signed by: Date:

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

INCOMPLETE INFORMATION WILL BE GROUNDS FOR REJECTION

SECTION 01 7000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

G. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

B. Section 01 4000 - Quality Requirements: Testing and inspection procedures.

C. Section : Project record documents, operation and maintenance data, warranties, and bonds.

D. Section 02 4100 - Demolition: Selective demolition of building elements for alterations purposes.

E. Individual Product Specification Sections:
   1. Advance notification to other sections of openings required in work of those sections.
   2. Limitations on cutting structural members.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
   2. Identify demolition firm and submit qualifications.
   3. Include a summary of safety procedures.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.
   6. Include in request:
      a. Identification of Project.
      b. Location and description of affected work.
      c. Necessity for cutting or alteration.
      d. Description of proposed work and products to be used.
      e. Alternatives to cutting and patching.
      f. Effect on work of Owner or separate Contractor.

g. Written permission of affected separate Contractor.
h. Date and time work will be executed.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

A. For survey work, employ a Professional Land Surveyor licensed in the State in which the Project is located and acceptable to Architect. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

C. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.06 PROJECT CONDITIONS

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water.

C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
1. Minimize amount of bare soil exposed at one time.
2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

G. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

H. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
1. Contractor shall schedule ordering of products, taking lead-times into account, and shall be responsible for any cost associated with expediting delivery of specified items in order to keep project on schedule.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner-occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 - PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
   1. Every trade shall examine substrate to determine if it is adequate to receive the work of that section prior to initiating work.
   2. Notify Contractor of any deficiencies needing correction.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

E. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

F. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

G. Utilize Standards of Practice for Professional Land Surveyors.

H. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.

I. Periodically verify layouts by same means.

J. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-conforming work.

C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

D. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

F. Restore work with new products in accordance with requirements of Contract Documents.

G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

I. Patching:
   1. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.
   2. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   3. Match color, texture, and appearance.
   4. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Prohibit traffic from landscaped areas.

H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.09 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

B. Testing, adjusting, and balancing HVAC systems: See appropriate Division 23 Section.

3.10 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Use cleaning materials that are nonhazardous.

C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Replace filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.11 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect.

B. The Contractor shall generate and provide a punch-list to the Architect prior to requesting inspection for substantial completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Accompany Architect on Contractor's preliminary final inspection.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.12 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

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SECTION 01 7419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, incineration, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.

E. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.

F. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

C. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

D. Section : Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

1. Return: To give back reusable items or unused products to vendors for credit.

I. Reuse: To reuse a construction waste material in some manner on the project site.

J. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

K. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

L. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

M. Toxic: Poisonous to humans either immediately or after a long period of exposure.

N. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

O. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
   1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
   2. Submit Report on a form acceptable to Owner.
   3. Landfill Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project disposed of in landfills.
      c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   4. Incinerator Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project delivered to incinerators.
      c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   5. Recycled and Salvaged Materials: Include the following information for each:
      a. Identification of material, including those retrieved by installer for use on other projects.
      b. Amount, in tons or cubic yards (cubic meters), date removed from the project site, and receiving party.
      c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
      e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
   6. Material Reused on Project: Include the following information for each:
      a. Identification of material and how it was used in the project.
      b. Amount, in tons or cubic yards (cubic meters).
      c. Include weight tickets as evidence of quantity.

d. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

A. See Section 01 6000 - Product Requirements for substitution submission procedures.

B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 6000:
   1. Relative amount of waste produced, compared to specified product.
   2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Sum.
   3. Proposed disposal method for waste product.
   4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.

C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.

D. See Section for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
   1. Pre-bid meeting.
   2. Pre-construction meeting.
   3. Regular job-site meetings.
   4. Job safety meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. As a minimum, provide:
      a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
      b. Separate dumpsters for each category of recyclable.
      c. Recycling bins at worker lunch area.
   2. Provide containers as required.
   3. Provide temporary enclosures around piles of separated materials to be recycled or salvaged.
   4. Provide materials for barriers and enclosures that are nonhazardous, recyclable, or reusable to the maximum extent possible; reuse project construction waste materials if possible.

5. Locate enclosures out of the way of construction traffic.
6. Provide adequate space for pick-up and delivery and convenience to subcontractors.
7. If an enclosed area is not provided, clearly lay out and label a specific area on-site.
8. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.

B. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment. All record documents, warranties and O&M manuals are to be submitted in paper format (1 copy) along with 1 digital download of PDF's of the documents.

B. At completion of Project, the Contractor shall submit to Architect a complete set of clearly marked-up Project Documents, as follows:
   1. One (1) Original Set clearly marked as-built, record drawings and specifications.
   2. One (1) Digitally Downloadable Version: With as-built record drawings and as-built record specifications along with O&M Manuals and Warranties.

C. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit one paper set and one digital download of revised final documents in final form within 10 days after final inspection, each with as-built record drawings and as-built record specifications along with O&M Manuals and Warranties as referenced above.

D. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
   4. Submit digital download of as-built record drawings and as-built record specifications along with O&M Manuals and Warranties as referenced above.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured depths of foundations in relation to finish first floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract drawings.

G. Scan marked-up Record Drawings and Specifications onto a digitally downloadable file (with as-built record drawings and as-built record specifications).

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.
2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

F. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Include color coded wiring diagrams as installed.

E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

G. Provide servicing and lubrication schedule, and list of lubricants required.

H. Include manufacturer's printed operation and maintenance instructions.
   1. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Provide control diagrams by controls manufacturer as installed.

K. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Include test and balancing reports.

O. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

D. Prepare data in the form of an instructional manual.

E. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

F. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

G. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

H. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

I. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

J. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

L. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.

M. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Certificates.

N. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

O. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Manual: Bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) three D side ring binders with durable plastic covers.

F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

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SECTION 02 3213
SUBSURFACE INVESTIGATION

PART 1 - GENERAL

1.01 GENERAL

A. Subsurface investigation was conducted, and a report (Geotechnical Exploration dated September 9, 2025, GMC Project No. GBHM250037) was issued by:
   1. GOODWYN MILLS CAWOOD, LLC.
   2. Michael McNeil, P.E.
   3. 2400 5th Avenue South, Suite 200
   4. Birmingham, AL 35233
   5. Phone: (205) 879-4462

B. The investigations are performed to assist the Architect and Consulting Engineers in the design of the project and are available to the Contractor as available information only.

C. The Reports will be available for review at the Architect's offices.

D. One (1) copy of the reports will be furnished to any General Contractor bidding this project who requests it, and to any Plan Rooms listed that request it.

E. Upon request, properly qualified Subcontractors for Earthwork will also be provided one (1) copy of the reports.

F. The reports *are not part of the Contract Documents.*

G. Interpretation:
   1. Bidders shall make their own investigation of subsurface conditions, for neither the Owner nor the Architect assumes responsibility for the accuracy or completeness of the information contained in the report, nor will the Owner or the Architect be responsible for the additional compensation for work performed on the basis of Bidders' assumptions based on the report.
   2. Note however, that it is expected that Contractors will utilize the Owner's Reports of "Geotechnical Subsurface Investigation" (or similar name) much the same as have the Architect and Engineers. However, as indicated, neither the Owner nor the Architect accept any responsibility whatsoever for the information contained in the reports, nor for any interpretations others make based on the information contained therein.
      a. In the event of unforeseen existing conditions encountered during the Work of the project, there are provisions within the Contract Documents to compensate the Contractor for any required and properly authorized additional work.

H. Refer to other Sections of the Project Manual and the Drawings for additional information and requirements.

PART 2 - PRODUCTS

2.01 NOT APPLICABLE TO THIS SECTION.

PART 3 - EXECUTION

3.01 NOT APPLICABLE TO THIS SECTION.

END OF SECTION

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SECTION 02 4100

DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Selective demolition of built site elements.

B. Abandonment and removal of existing utilities and utility structures.

1.2 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 01 1000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.

C. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

D. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

E. Section 01 7000 – Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

F. Section 31 1000 - Site Clearing: Vegetation and existing debris removal.

G. Section 31 2000 – Earth Moving: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.3 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2004.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Site Plan: Showing:

1. Areas for temporary construction and field offices.

2. Areas for temporary and permanent placement of removed materials.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.

1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.

2. Identify demolition firm and submit qualifications.

3. Include a summary of safety procedures.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.5 QUALITY ASSURANCE

A. Demolition Firm Qualifications:

1. Company specializing in the type of work required.

B. Regulatory Requirements: Comply with governing EPA notification regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

1. Where required by local Health Department or other authorities having jurisdiction, provide certificate of pest and rodent eradication and subsequent inspection completed prior to and after building demolition.

C. Pre-demolition Conference: Demolition will be reviewed at required Preconstruction Conference for the Project.

1. In addition, conduct pre-demolition conferences at Project site with Owner's representatives, to provide final notice to and coordination with Owner's representatives and on-site personnel.

D. Notices: Contractor shall provide all notices required by Code, applicable regulations, ordinances and/or local and other authorities having jurisdiction.

1. All notices shall be in writing, with copies provided to the Owner and Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill Material: As specified in Section 31 2000 – Earth Moving.

PART 3 – EXECUTION

3.1 SCOPE

A. Extent of demolition is indicated on the Plan.

B. Remove paving and curbs as required to accomplish new work.

C. Remove items indicated

D. Remove other items indicated, for salvage, relocation, and recycling.

E. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 2000.

F. Salvage, relocate, or recycle as directed and as applicable.

a. The Owner reserves the right of first refusal for any structures, materials, and/or accessory items on site or within the buildings including, but not limited to, fire alarm panels and accessories, door hardware, electrical transformers, copper tubing, onsite trees and shrubs, and other items of value that may or may not be shown on the plans or called out in the project manual. Any items removed from the site without prior approval from the Owner will be paid to the Owner by the contractor at two times (2x) the market value.

G. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as required so that required rough grade elevations do not subside within one year after completion.

3.2 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.

1. Obtain required permits.

2. Comply with applicable requirements of NFPA 241.

3. Use of explosives is not permitted.

4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.

5. Provide, erect, and maintain temporary barriers and security devices.

6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.

7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.

8. Do not close or obstruct roadways or sidewalks without permit.

9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.

10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of Notification To Proceed from Owner.

C. Do not begin removal until built elements to be salvaged or relocated have been removed and delivered to a location as directed by the Owner.

D. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.

E. Protect existing structures and other elements that are not to be removed.

1. Provide bracing and shoring.

2. Prevent movement or settlement of adjacent structures.

3. Stop work immediately if adjacent structures appear to be in danger.

F. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

G. If hazardous materials are discovered during removal operations, stop work and notify Engineer and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

1. Removal of asbestos shall be subject to state and local regulatory requirements.

H. Perform demolition in a manner that maximizes salvage and recycling of materials.

1. Dismantle existing construction and separate materials.

2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

I. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.3 EXISTING UTILITIES

A. Coordinate work with utility companies.
   1. The locations of existing underground utilities are shown in an approximate manner only. The Contractor shall determine exact location of all existing utilities before commencing work. The contractor shall be fully responsible for any and all damages which might be occasioned by his failure to exactly locate and preserve any and all underground utilities. The Contractor shall contact Alabama One Call (811) a minimum of 48 hours prior to excavation. If no paint is visible, Contractor shall not perform excavation until verifying with that work site is cleared for excavation.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 5 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.4 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.

   1. Verify that construction and utility arrangements are as shown.

   2. Report discrepancies to Engineer or Engineers before disturbing existing installation.

   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Remove existing work as indicated and as required to accomplish new work.

   1. Remove items indicated on drawings.

C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.

   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.

2. Where existing active systems serve occupied facilities, but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.

3. Verify that abandoned services serve only abandoned facilities before removal.

4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

E. Protect existing work to remain.

1. Prevent movement of structure; provide shoring and bracing if necessary.

2. Perform cutting to accomplish removals neatly and as specified for cutting new work.

3. Repair adjacent construction and finishes damaged during removal work.

4. Patch as specified for patching new work.

3.5 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash and legally dispose of off-site.

B. Remove from site all materials not to be reused on site; do not burn or bury.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

END OF DEMOLITION



04/27/2026

FOR SPECIFICATION SECTIONS
01 4100, 03 3100, 05 1200, 05 3100, AND 05 4500

SECTION 03 3100

CONCRETE

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:

1. Formwork.
2. Reinforcing.
3. Cast-in place concrete including mix design, placement procedures, and finishes.

B. Cast-in-place concrete includes the following:

1. Foundations and footings.
2. Slabs-on-grade.
3. Equipment pads and bases.

C. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

D. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 02 2000, "Earthwork": Drainage fill under slabs on grade.
2. Section 02 5140, "Portland Cement Concrete Paving": Concrete paving and walks.
3. Section 03 3500, “Concrete Toppings”
4. Section 03 4100, “Structural Precast Concrete”
5. Section 04 2000, "Unit Masonry": Concrete fill for masonry lintels.
6. Section 05 5000, "Metal Fabrications": Metal items to be built into concrete.
7. Section 07 9000, "Sealants and Joint Fillers": Sealants and joint fillers in concrete work.
8. Section 09 6260, “Resilient Athletic Flooring”
9. Respective Sections of Division 15 and 16, as applicable, for furnishing of inserts, anchorage and erection items required for mechanical and electrical work..
10. Divisions 15 and 16, as applicable, for furnishing and setting of conduit, pipes and sleeves for mechanical and electrical equipment.

1.2 SUBMITTALS:

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect.

C. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and

arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.

D. Samples of materials as requested by Architect, including names, sources, and descriptions, as follows:

1. Color finishes.
2. Normal weight aggregates.
3. Reglets.
4. Waterstops.
5. Vapor retarder/barrier.

E. Laboratory test reports for concrete materials and mix design test.

F. Minutes of pre-installation conference.

1.3 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. ACI 301, "Specifications for Structural Concrete for Buildings".
2. ACI 302, "Guide for Concrete Floor and Slab Construction".
3. ACI 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".
4. ACI 305, "Hot Weather Concreting".
5. ACI 306, "Cold Weather Concreting".
6. ACI 309, "Guide for Consolidation of Concrete".
7. ACI 311, "Recommended Practice for Concrete Inspection".
8. ACI 318, "Building Code Requirements for Reinforced Concrete".
9. ACI 347, "Recommended Practice for Concrete Formwork".
10. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."
11. American Welding Society, AWS D1.4 "Structural Welding Code - Reinforcing Steel".

B. Concrete Testing Service: Engage a testing agency acceptable to Architect to perform material evaluation tests and to design concrete mixes.

C. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings" and the following:

1. At least 35 days prior to submitting design mixes, conduct a meeting to review detailed requirements for preparing concrete design mixes and to determine procedures for satisfactory concrete operations. Review requirements for submittals, status of coordinating work, and availability of materials. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications. Require representatives of each entity directly concerned with cast-in-place concrete to attend conference, including, but not limited to, the following:

a. Contractor's superintendent.
b. Agency responsible for concrete design mixes.
c. Agency responsible for field quality control.
d. Ready-mix concrete producer.
e. Concrete subcontractor.
f. Primary admixture manufacturers.

PART 2 - PRODUCTS

2.1 FORM MATERIALS:

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

1. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form," Class I.

2. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Form Liner: Pattern 16020 Rough Sawn Plank, Rough Grain Plank, horizontal orientation by Fitzgerald Formliners, or equal – Concrete walls at monumental stair. Coordinate location with architectural drawings.

D. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

E. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to the plane of the exposed concrete surface.

F. Provide ties that, when removed, will leave holes not larger than 1 inch in diameter in the concrete surface.

2.2 REINFORCING MATERIALS:

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Steel Wire: ASTM A 82, plain, cold-drawn steel.

C. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

D. Deformed-Steel Welded Wire Fabric: ASTM A 497.

E. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

F. Threaded Dowels: Continuous threaded high-strength steel bars equal to "Lasstud" by Richmond Screw Anchor Co., Inc. Provide inserts compatible with dowels, designed for ultimate pull-out force indicated on the drawings.

G. Mechanical Splices: Equal to "Cadweld Rebar Splices", as manufactured by Erico Products, Inc., "C" Series, for developing 125% of minimum ASTM specified yield strengths, unless otherwise noted on drawings.

H. Steel Shapes, Plates and Rods: Conform to ASTM A 36, "Specification for Structural Steel".

I. Do Not Weld Reinforcing Steel: Unless specifically noted on drawings. If welding is shown, conform to latest revision of AWS D12.1, "Reinforcing Steel Welding Code of the American Welding Society". Perform all welding with certified welders qualified per AWS.

2.3 CONCRETE MATERIALS:

A. Portland Cement: ASTM C 150, Type I.

1. Use one brand of cement throughout Project unless otherwise acceptable to Architect.

B. Fly Ash: ASTM C 618, Type F or C.

1. Limit use of fly ash to not exceed 20 percent of cement content by weight.

C. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.

1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.

D. Water: Potable.

E. Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other

required admixtures.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Air-Tite, Cormix Construction Chemicals.
   b. Air-Mix or Perma-Air, Euclid Chemical Co.
   c. Darex AEA or Daravair, W.R. Grace & Co.
   d. MB-VR or Micro-Air, Master Builders, Inc.
   e. Sealtight AEA, W.R. Meadows, Inc.
   f. Sika AER, Sika Corp.

G. Water-Reducing Admixture: ASTM C 494, Type A.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. PSI N, Cormix Construction Chemicals.
   b. Eucon WR-75, Euclid Chemical Co.
   c. WRDA, W.R. Grace & Co.
   d. Pozzolith Normal or Polyheed, Master Builders, Inc.
   e. Plastocrete 161, Sika Corp.

H. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Eucon 37, Euclid Chemical Co.
   b. WRDA 19 or Daracem, W.R. Grace & Co.
   c. Rheobuild or Polyheed, Master Builders, Inc.
   d. Sikament 300, Sika Corp.

I. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Accelguard 80, Euclid Chemical Co.
   b. Daraset, W.R. Grace & Co.
   c. Pozzutec 20, Master Builders, Inc.

J. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Eucon Retarder 75, Euclid Chemical Co.
   b. Daratard-17, W.R. Grace & Co.
   c. Pozzolith R, Master Builders, Inc.
   d. Protard, Prokrete Industries.
   e. Plastiment, Sika Corporation.

2.4 RELATED MATERIALS:

A. Reglets: Where sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.0217-inch-thick (26-gage) galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

B. Vapor Barrier:

1. Vapor Barrier, General Use (except as indicated below):

    a. Product: Plastic vapor barrier. Include manufacturer's recommended adhesive or pressure-sensitive tape for sealing joints, laps and penetrations, preformed boots for penetrations, and all other components required for a complete, proper and vaporproof installation in accordance with ASTM E1643.
        1) Classification: Must exceed ASTM E 1745 Class "A".
        2) Permeance: ASTM E96: 0.02 perms or less.
        3) Thickness: Not less than 15 mils.

    b. Manufacturer/Product:
        1) "Moistop Ultra 15 mil", Fortifiber Building Systems Group.
        2) "Perminator 15 mil", W.R. Meadows
        3) "Griffolyn Type-105", Reef Industries, Inc.
        4) "Stego Wrap 15 mil", Stego Industries, LLC.
        5) "VaporBlock VB15", Raven Inc.
        6) "Husky Yellow Guard 15 mil", Poly-America, L.P.

    c. "Locations for Use: Continuous below all new and opened building slabs, and other structural slabs, porches, stoops, pads, covered (below roofs) areas, etc., on grade, and turned-down to tops of footings.

2. Vapor Barrier, **Below Wood Flooring**: Provide below and 5'-0" beyond all wood flooring; Premolded seven-ply membrane consisting of reinforced core and carrier sheet with fortified bitumen layers, protective weathercoating, and plastic anti-stick sheet. Provide manufacturer's recommended mastics and gusset tape.

    a. Product/Manufacturer: Subject to compliance with requirements, provide "Premoulded Membrane Vapor Seal with Plasmatic Core," as manufactured by W.R. Meadows, Inc.; Austell, GA.
    b. Locations for Use: Continuous below and 5'-0" beyond all wood flooring.

C. Nonslip Aggregate Finish: Provide fused aluminum oxide granules or crushed emery as the abrasive aggregate for a nonslip finish, with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof, nonglazing, and unaffected by freezing, moisture, and cleaning materials.

D. Colored Wear-Resistant Finish: Packaged dry combination of materials consisting of portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground nonfading mineral oxides interground with cement. Color as selected by Architect from manufacturers' standards, unless otherwise indicated.

1. Products: Subject to compliance with requirements, provide one of the following:
    a. Quartz Tuff, Dayton-Superior.
    b. Surflex, Euclid Chemical Co.
    c. Colorundum, A.C. Horn, Inc.
    d. Quartz Plate, L&M Construction Chemicals, Inc.
    e. Colorcron, Master Builders, Inc.
    f. Lithochrome Color Hardener, L.M. Scofield Co.
    g. Harcol Redi-Mix, Sonneborn-Chemrex.
    h. Hard Top, Symons Corp.

E. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

F. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.

G. Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.55 kg/sq. meter when applied at 200 sq. ft./gal.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Spartan-Cote, The Burke Co.
   b. Day-Chem Cure and Seal, Dayton Superior Corp.
   c. Eucocure, Euclid Chemical Co.
   d. Horn Clear Seal, A.C. Horn, Inc.
   e. L&M Cure R, L&M Construction Chemicals, Inc.
   f. Masterkure, Master Builders, Inc.
   g. CS-309, W.R. Meadows, Inc.
   h. Kure-N-Seal, Sonneborn-Chemrex.

H. Water-Based Acrylic Membrane Curing Compound: ASTM C 309, Type I, Class B.

1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Sealco - VOC, Cormix Construction Chemicals.
   b. Safe Cure and Seal, Dayton Superior Corp.
   c. Aqua-Cure, Euclid Chemical Co.
   d. Dress & Seal WB, L&M Construction Chemicals, Inc.
   e. Masterkure 100W, Master Builders, Inc.
   f. Vocomp-20, W.R. Meadows, Inc.

I. V.O.C. Compliant Acrylic Curing and Sealing Type (30 Percent): Liquid type membrane-forming curing compound complying with ASTM C 309, Type 1, Class A and B. Provide 30 percent solids minimum, for surfaces indicated to be sealed.

J. Safe Cure and Seal: 30 percent (J-19), Dayton Superior Inc.

K. Evaporation Control:

1. Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1. Eucobar, Euclid Chemical Co.
      2. E-Con, L&M Construction Chemicals, Inc.
      3. Confilm, Master Builders, Inc.

L. V.O.C. Compliant Evaporation Control: Sure Film (J-74), Dayton Superior Inc.

M. Underlayment Compound: Free-flowing, self-leveling, pumpable, cement-based compound for applications from 1 inch thick to feathered edges.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. K-15, Ardex, Inc.
   b. LevelLayer II, Dayton Superior Corp.
   c. Flo-Top, Euclid Chemical Co.
   d. Gyp-Crete, Gyp-Crete Corp.
   e. Levelex, L&M Construction Chemicals, Inc.
   f. Underlayment 110, Master Builders, Inc.
   g. Thoro Underlayment Self-Leveling, Thoro System Products.

N. Bonding Agent: Polyvinyl acetate or acrylic base.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Polyvinyl Acetate (Interior Only):
      1. Superior Concrete Bonder, Dayton Superior Corp.
      2. Euco Weld, Euclid Chemical Co.
      3. Weld-Crete, Larsen Products Corp.
      4. Everweld, L&M Construction Chemicals, Inc.
      5. Ready Bond, Symons Corp.
   b. Acrylic or Styrene Butadiene:
      1. Acrylic Bondcrete, The Burke Co.
      2. Day-Chem Ad Bond, Dayton Superior Corp.
      3. SBR Latex, Euclid Chemical Co.
      4. Daraweld C, W.R. Grace & Co.
      5. Hornweld, A.C. Horn, Inc.
      6. Everbond, L&M Construction Chemicals, Inc.
      7. Acryl-Set, Master Builders Inc.
      8. Intralok, W.R. Meadows, Inc.
      9. Sonocrete, Sonneborn-Chemrex.

O. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Resi-Bond (J-58), Dayton Superior.
   b. Euco Epoxy System #452 or #620, Euclid Chemical Co.
   c. Epoxtite Binder 2390, A.C. Horn, Inc.
   d. Epabond, L&M Construction Chemicals, Inc.
   e. Concresive Standard Liquid, Master Builders, Inc.
   f. Rezi-Weld 1000, W.R. Meadows, Inc.
   g. Sikadur 32 Hi-Mod, Sika Corp.

P. Interior Epoxy Sealer: Use a maximum 35 percent type.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Epoxy-Plus; Dayton Superior Inc.
   b. Eucopoxy 1; Euclid Chemical
   c. Oauerseal 30E; Non-Crete, Inc.
   d. Rescon R117; Symons Corp.
   e. Son-No-Mar; Sonneborn, Div./Chem Rex Inc.
   f. Super Seal 35; L & M Const. Chem. Co.

Q. V.O.C. Compliant Urethane Sealer:

1. Day Chem Urethane V.O.C. (J-39); Dayton Superior Inc.

2.5 PROPORTIONING AND DESIGNING MIXES:

A. Prepare design mixes for each type and strength of concrete by either laboratory trial mixtures or field experience methods as specified in ACI 318-05 Section 5.3. If trial mixtures method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing, unless otherwise acceptable to Architect.

B. Trial mix designs and strength tests, made by qualified independent material laboratory, in accordance with ACI 318-05 Section 5.3 are required for the following types of concrete:

1. Normal weight concrete with specified strength in excess of 4000 psi.
2. All concrete designs for which a suitable experience record is not available.

C. Mix design based on a record of past performance in accordance with ACI 318-05 Section 5.3, may be provided by qualified concrete supplier or precast concrete manufacturer for concrete designs. Mix design shall be certified by an independent testing laboratory.

D. All concrete mix designs shall include the following information:

1. Proportions of cement, fine and coarse aggregate and water.
2. Water/cement ratio, design strength, slump and air content.
3. Type of cement and aggregates.
4. Type and dosage of all admixtures.
5. Type, color and dosage of integral coloring compounds, where applicable.
6. Special requirements for pumping.
7. Any special characteristics of the mix which require precautions in the mixing, placing or finishing techniques to achieve the finished product specified.

E. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect.

F. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:

1. Subjected to freezing and thawing: W/C 0.45.
2. Subjected to deicers/watertight: W/C 0.40.

3. Subjected to brackish water, salt spray, or deicers: W/C 0.40.

G. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps and sloping surfaces: Not more than 3 inches.
2. Reinforced foundation systems: Not less than 1 inch and not more than 3 inches.
3. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2-to-3-inch slump concrete.
4. Other concrete: Not less than 3 inches and not more than 5 inches.

2.6 ADMIXTURES:

A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg.F (10 deg.C).

C. Use high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.

D. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:

1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:
   a. 4.5 percent (moderate exposure); 5.5 percent (severe exposure) for 1-1/2-inch maximum aggregate.
   b. 4.5 percent (moderate exposure); 6.0 percent (severe exposure) for 1-inch maximum aggregate.
   c. 5.0 percent (moderate exposure); 6.0 percent (severe exposure) for 3/4-inch maximum aggregate.
   d. 5.5 percent (moderate exposure); 7.0 percent (severe exposure) for 1/2-inch maximum aggregate.
2. Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener: 2 to 4 percent air.

E. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.

1. When air temperature is between 85 deg.F (30 deg.C) and 90 deg.F (32 deg.C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg.F (32 deg.C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 GENERAL:

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.2 FORMS:

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

1. Provide Class A tolerances for concrete surfaces exposed to view.
2. Provide Class C tolerances for other concrete surfaces.

B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.3 VAPOR RETARDER/BARRIER INSTALLATION:

A. General: Place vapor retarder/barrier sheeting in position with longest dimension parallel with direction of pour.

B. Lap vapor barrier over footings and/or seal to foundation walls.

C. Lap joints 6 inches and seal with manufacturer's recommended mastic or pressure-sensitive tape.

D. Seal all penetrations (including pipes) per manufacturer’s instructions.

E. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.

F. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.

3.4 PLACING REINFORCEMENT:

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.

1. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect.

D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS:

A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Architect.

B. Provide keyways at least 1-1/2 inches deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across

construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

E. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Joint fillers and sealants are specified in Section 07900, "Sealants and Joint Fillers".

F. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts 1/8 inch wide by one-fourth of slab depth or inserts 1/4 inch wide by one-fourth of slab depth, unless otherwise indicated.

1. Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
3. If joint pattern is not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
4. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

3.6 INSTALLING EMBEDDED ITEMS:

A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

B. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.

C. Install dovetail anchor slots in concrete structures as indicated on drawings.

D. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.7 PREPARING FORM SURFACES:

A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

1. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.8 CONCRETE PLACEMENT:

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
3. Maintain reinforcing in proper position on chairs during concrete placement.

F. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

G. When air temperature has fallen to or is expected to fall below 40 deg.F (4 deg.C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg.F (10 deg.C) and not more than 80 deg.F (27 deg.C) at point of placement.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete

on frozen subgrade or on subgrade containing frozen materials.

2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg.F (32 deg.C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.

3.9 FINISHING FORMED SURFACES:

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Smooth-Rubbed Finish: Provide smooth-rubbed finish on scheduled concrete surfaces that have received smooth-formed finish treatment not later than 1 day after form removal.

1. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 MONOLITHIC SLAB FINISHES:

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor

topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.

1. After placing slabs, finish surface to tolerances specified in Section 3.11. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances specified in Section 3.11. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.

1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances specified in Section 3.11. Grind smooth any surface defects that would telegraph through applied floor covering system.

D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.

E. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

F. Colored Wear-Resistant Finish: Apply a colored wear-resistant finish to monolithic slab surface indicated.

1. Apply dry shake materials for the colored wear-resistant finish at a rate of 100 lb per 100 sq. ft., unless a greater amount is recommended by material manufacturer.
2. Cast a trial slab approximately 10 feet square to determine actual application rate, color, and finish, as acceptable to Architect.
3. Immediately following the first floating operation, uniformly distribute with mechanical spreader approximately two-thirds of the required weight of the dry shake material over

the concrete surface, and embed by power floating. Follow floating operation with second shake application, uniformly distributing remainder of dry shake material with overlapping applications to ensure uniform color, and embed by power floating.

4. After broadcasting and floating, apply a trowel finish as specified. Cure slab surface with a curing compound recommended by the dry shake material manufacturer. Apply the curing compound immediately after the final finishing.

3.11 FLOOR FLATNESS/LEVELNESS REQUIREMENTS:

A. After placing slabs, finish surface to the following tolerances of F(F) (floor flatness) and F(L) (floor levelness) measured according to ASTM E 1155:

FINISH	SLAB-ON-GRADE				FRAMED FLOOR	
	OVERALL		LOCAL		OVERALL	LOCAL
	FF	FL	FF	FL	FF	FF
Scratch Finish	18	15	15	13	25	22
Float Finish	20	17	18	15	25	22
Trowel Finish	25	22	20	17	25	22

Specified overall F-numbers apply to the whole floor, taken as one. Minimum local F-numbers apply to each slab, bounded by construction joints.

3.12 MISCELLANEOUS CONCRETE ITEMS:

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.13 CONCRETE CURING AND PROTECTION:

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. No curing agents or sealers are to be applied to the concrete slab where Resilient Athletic Flooring is scheduled.

C. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

D. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

1. Provide moisture curing by the following methods:

a. Keep concrete surface continuously wet by covering with water.
b. Use continuous water-fog spray.
c. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.

2. Provide moisture-retaining cover curing as follows:
a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:
a. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
b. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

E. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

F. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.

1. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.14 REMOVING FORMS:

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg.F (10 deg.C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75

percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.15 REUSING FORMS:

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Architect.

3.16 CONCRETE SURFACE REPAIRS:

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Architect.

B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

1. Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.

2. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and

smoothness by using a template having the required slope.

1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.
4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.

F. Repair methods not specified above may be used, subject to acceptance of Architect.

3.17 QUALITY CONTROL TESTING DURING CONSTRUCTION:

A. General: The Owner will employ a testing agency to perform tests and to submit test reports.

B. Sampling and testing for quality control during concrete placement may include the following, as directed by Architect.

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
   a. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
   b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
   c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg.F (4 deg.C) and below, when 80 deg.F (27 deg.C) and above, and one test for each set of compressive-strength specimens.
   d. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.

C. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in

any one day, or for each 5000 sq ft of surface are placed; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

1. Any additional cylinder required by the Contractor for early strength gain tests for form stripping or post-tensioning are Contractor's responsibility and shall be paid for by Contractor.
2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
3. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive strength testing if adequate evidence of satisfactory strength is provided.
4. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.
6. Test results will be reported in writing to Architect, Structural Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.
7. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
8. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF CONCRETE

SECTION 03 3931
CURING, SEALING AND HARDENING CONCRETE FLOORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Floors denoted on Finish Schedule as SC (Sealed Concrete).

B. Related Sections
   1. Drawings and general provisions of Contract, including General Conditions and Division 1 Specification Sections, apply to the work of this Section.
   2. Section 03 3100 - Concrete.

1.02 SUBMITTALS

A. Contractor shall submit specified manufacturer's complete technical data sheets for all products to be used, including installation instructions.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of specified sealer shall have a minimum 10 years experience in the production of the specified products.

B. Contractor Qualifications: Contractor must have a minimum 3 years experience in sealing applications and successfully completed not less than 6 projects comparable in scale and complexity.

C. Regulatory Requirements
   1. Products shall comply with the United States Clean Air Act for maximum Volatile Organic Compound (VOC) content as specified in PART 2 of this section.

D. Mockups and Field Samples: Prepare field sample at project site for architects review and approval.
   1. Include Curing, Sealing and Hardening Concrete Floors in Mock-Up as described in Section 01 4000 - Quality Requirements.
   2. Samples shall be constructed on site and shall be 4'x4'. If there is existing concrete, the Architect shall select an area where the samples will be placed.
   3. Construct sample-using processes and techniques intended for use on permanent work, including curing procedures. Include samples of control, construction, and expansion joints in sample panels.
   4. Sample shall be sealed by the individual workers who will actually be performing the work for the project.
   5. Obtain written approval of the sample from project Architect before start of work.
   6. Retain approved samples through completion of the work for use as a quality standard for finished work.
   7. The mockup may remain part of the finished work if approved.

E. Mandatory Pre Pour Installation Conference: Conduct conference at project site to comply with requirements in Division 1 Sections “Special Conditions” and “Administrative Requirements”.
   1. The mandatory preinstallation conference shall occur prior to any concrete pours.
   2. The purpose of the mandatory preinstallation conference is to review the criteria with the General Contractor, concrete subcontractor, concrete finish manufacturer, and concrete finish installer.
   3. The meeting shall establish the following:
      a. Roles and expectations of each subcontractor.
      b. Days and times of concrete pour schedules.
      c. Sequencing of operations for pouring, curing, finishing and protection of finished concrete surfaces.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver the specified products in original, unopened containers with legible manufacturer's identification and information.

B. Store specified products in conditions recommended by the manufacturer.

1.05 JOB SITE CONDITIONS

A. Environmental Conditions: Maintain an ambient temperature of between 50° F and 90° F during application and at least 48 hours after application.

B. Protection: Precautions shall be taken to avoid damage or contamination of any surfaces near the work zone. Protect completed stain work from moisture or contamination.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Prosoco, Inc.: www.prosoco.com.

B. Dayton Superior Corporation: www.daytonsuperior.com.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PRODUCTS

A. Consolideck LS/CS lithium silicate sealer, hardener & densifier for concrete [Basis of Design]: www.prosoco.com.
   1. Provide with protection and sheen enhancer coat. LSGuard by Prosoco [Basis of Design].

B. Pentra-Hard Densifier lithium silicate densifier, sealer, dustproofer and hardener for concrete: www.daytonsuperior.com.
   1. Provide with protection and sheen enhancer coat recommended by manufacturer.

C. Substitutions: The use of any products other than those specified will be considered providing that the contractor requests its use in writing within fourteen (14) days prior to bid date. This request shall be accompanied by:
   1. A certificate of compliance from the material manufacturer stating that the proposed products meet or exceed the requirements for this specification.
   2. Documented proof that the proposed material has a five (5) year proven record of performance for sealing, hardening and densifying concrete substrates, confirmed by at least two (2) local projects that the Architect can examine.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Contractor shall examine areas and conditions under which work will be performed and identify conditions detrimental to proper and timely completion of work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. New Concrete
   1. Apply sealer/densifier immediately after final finishing and installation of control joints (if manufacturer's recommendations permit); when the concrete surface won't be marred by foot traffic and after joints have been cut and cleaned or anytime thereafter. Remove soft cut saw debris prior to applying sealer/densifier. Surface shall be swept, and mopped or pressure-washed as necessary to insure no dirt, grit, trash, or similar items mar finished product. Remove all markings, including paint, marker or pencil marks. Inspect floor surface prior to application to be sure it is ready for sealer/densifier.

B. Existing Concrete
   1. Remove all dirt, debris, or curing compounds using appropriate surface prep cleaner. Allow cleaning waters used in surface preparation to dry.

3.03 APPLICATION OF SEALER

A. New Concrete
   1. The surface shall be sealed with a sealer produced of the type specified under Products above.
      a. Also apply manufacturer's protection coat as specified above.
   2. Apply at the rates and method recommended by manufacturer in written instructions which the installer shall have at the job site.
   3. Apply a single coat using low pressure sprayer fitted with 0.5 gal/min spray tip. Lightly apply sufficient product to wet the surface without producing puddles. Use clean, soft bristle push broom or microfiber pad to spread the product evenly and ensure uniform wetting. Avoid spreading once drying begins. Scrubbing is not necessary.
   4. If surfaces dry immediately, increase the rate of application. Surfaces should remain wet 5 to 10 minutes. Adjust rate of application to eliminate puddles. Any white residue must be removed immediately.
   5. Allow treated surfaces to dry.
   6. For uncured steel troweled concrete, immediately apply the specified curing compound or initiate specified curing procedure.
   7. When the curing process is complete, use an automatic floor scrubber equipped with cleaning pads or brushes appropriate for removal of accumulated construction soiling and surface residues. Avoid pads or brushes which may damage the finished floor.

B. Existing Concrete
   1. The surface shall be sealed with a sealer produced of the type specified under Products above.
      a. Also apply manufacturer's protection coat as specified above.
   2. Apply at the rates and method recommended by manufacturer in written instructions which the installer shall have at the job site.
   3. Apply a single coat using low pressure sprayer fitted with 0.5 gal/min spray tip. Lightly apply sufficient product to wet the surface without producing puddles. Use clean, soft bristle push broom or microfiber pad to spread the product evenly and ensure uniform wetting. Avoid spreading once drying begins. Scrubbing is not necessary.
   4. If surfaces dry immediately, increase the rate of application. Surfaces should remain wet 5 to 10 minutes. Adjust rate of application to eliminate puddles. Any white residue must be removed immediately.
   5. Allow treated surfaces to dry.
   6. Remove any dried powder residue using a stiff broom, power sweeper, or auto-scrubbing machine.
   7. Dry-Buff or burnish concrete surface in both directions with orbital floor machine or burnisher equipped with appropriate polishing pad for additional surface sheen.

3.04 PROTECTION

A. Protection: General Contractor shall protect areas to receive sealed concrete finish at all times during construction to prevent oils, dirt, metal, excessive water and other potentially damaging materials from affecting the finished concrete surface. Protection measures listed below shall begin immediately after the concrete slab is poured.

B. Plywood slab protection in traffic corridors, entry ways, and areas to receive sealer shall be provided by and maintained by General Contractor throughout construction until the finishing contractor takes ownership of the floor. Protection shall be sufficient to protect surface from damage due to traffic and impact from any and all construction activities with a minimum of 1/2" plywood. All seams of plywood shall be sealed to eliminate passage of debris to new floor.

C. Protect slab during masonry work and after completion of sealed concrete finish work with minimum of 1/2-inch plyboard, with sealed seams.

D. Do not allow any trade to park any vehicles on the inside slab. If necessary to complete their scope of work, drop cloths will be placed under vehicles at all times.

E. Diaper all hydraulic powered equipment to avoid staining of the concrete.

F. Place no steel on interior slab to avoid rust stains and gouges. If construction dictates necessity of this, interior slab will be protected with 1/2-inch plyboard.

G. Do not allow acids and acidic detergents to come into contact with slab.

H. Inform all trades that the slab must be protected at all times.

I. Protect finished work until fully cured in accordance with manufacturer's recommendations.

J. Protect completed floor from damage until Substantial Completion.
   1. Do not allow vehicle and pedestrian traffic on unprotected floor.
   2. Do not allow construction materials, equipment, and tools on unprotected floor.

K. Immediately remove mortar splatter, spilled liquids, oil, grease, paint, coatings, and other surface contaminants which could adversely affect completed floor.

L. Repair damaged areas of completed floor to satisfaction of Architect.

M. Protect floor from traffic for at least 72 hours after final application of sealer.

N. Upon completion of sealer, the General Contractor and the finishing subcontractor shall replace the plywood protection for the duration of the project.

3.05 MAINTENANCE

A. Sealed floors should be maintained by sweeping. Spills should be cleaned when they occur and dirt shall be rinsed off with water. Heavily soiled areas may be wet-cleaned by mopping or by scrubbing with a rotary floor machine equipped with a scrubbing brush and a suitable, high quality commercial detergent. Interior floors that require polishing should be maintained using a compatible, premium-grade, emulsion-type, commercial floor polish, following manufacturer's instructions and safety requirements.

END OF SECTION

SECTION 04 2000
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.
B. Clay facing brick.
C. Face brick.
D. Mortar and grout.
E. Reinforcement and anchorage.
F. Flashings.
G. Accessories.
H. Water Repellents.

1.02 RELATED REQUIREMENTS

A. Section 01 2100 - Allowances: Masonry Mortar Coloring, and Face Brick Allowance.
B. Section 01 4000 - Quality Requirements: Requirements for mock-ups.
C. Section 03 3931 - Curing, Sealing and Hardening Concrete Floors: Protection of concrete slab during masonry work.
D. Section 04 7200 - Cast Stone Masonry.
E. Section 05 5000 - Metal Fabrications: Loose steel lintels.
F. Section 07 8400 - Firestopping: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.
G. Section 07 9005 - Joint Sealers: Backing rod and sealant at control and expansion joints.
H. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2100 - Allowances, for cash allowances affecting this section.
B. This allowance includes purchase and delivery of face brick and mortar color. Installation is not included in the allowance but is specified in this section and is part of the Contract Sum/Price.

1.04 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2026.
C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019 (Reapproved 2025).
D. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.
F. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2022.
G. ASTM C90 - Standard Specification for Dry-Cast Loadbearing Concrete Masonry Units; 2024a.
H. ASTM C91/C91M - Standard Specification for Masonry Cement; 2025.

I. ASTM C129 - Standard Specification for Dry-Cast Nonloadbearing Concrete Masonry Units; 2025.

J. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2026.

K. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2025.

L. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.

M. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2024.

N. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2024.

O. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2025b.

P. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2024.

Q. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

R. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2025a.

S. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength; 2022.

T. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2024.

U. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2025.

V. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2020.

W. BIA Technical Notes No. 28B - Brick Veneer/Cold-Formed Steel Framed Walls; 2025.

X. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.

Y. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.

Z. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.

AA. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

BB. UL (FRD) - Fire Resistance Directory; Current Edition.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, masonry accessories, and water repellant and other manufactured products indicated, including certifications that each item and type complies with specified requirements. Also, submit product data for flashings and accessories..

C. Samples: Flashings: Submit two 4 x 4 inch samples of masonry flashings.

D. Shop drawings for reinforcing, if any, detailing fabrication, bending, and placement of unit masonry reinforcing bars. Comply with ACI 315(Details and Detailing of Concrete Reinforcing), showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement.

E. Coordination Drawing indicating the locations of proposed CMU control joints.

F. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

G. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Facing Brick units: 500 of each type, size and color combination.

1.07 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Fire Rated Assemblies: Conform to applicable code for fire performance requirements for fire rated masonry construction. Where indicated, provide materials and construction identical to those of assemblies whose fire resistance has been determined per ASTM E 119 by a testing and inspecting organization, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

C. Single Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

D. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

E. Single-Source Responsibility for Water Repellents: Obtain each type of integral water repellents from a single manufacturer for the entire project.
   1. Verify full compatibility with any other coatings, fluid applied waterproofing, etc., prior to application of this and other products. Notify Architect in writing and in detail, of any incompatible products, prior to any application, and await Architect's written direction on how to proceed.

F. Single-Source Responsibility for Through-Wall Flashings: Self-adhering membrane flashings associated with through-wall flashings in this Section shall be manufactured by the manufacturer of the water/air barrier coating specified in Section 07 1400 - Fluid Applied Air Barrier, for material compatibility and single-source manufacturing responsibility.

1.08 MOCK-UPS

A. Include Unit Masonry in mock-up as described in Section 01 4000 - Quality Requirements.

B. Construct a representative wall sample, 6 feet wide by 10 feet high, which includes face brick, mortar and accessories, architectural masonry veneer, cast stone, metal-framed storefronts, with masonry back-up and metal stud and sheathing backup where applicable; with accompanying flashing, sealants, and waterproofing (air barrier). Also, eave condition, including soffit and gutter is included. This panel will be for the purpose of approving the wall system, and its components.

C. Construct two additional separate masonry walls as a mock-up panel sized 4 feet long by 4 feet high, including one (1) vertical control joint, which include mortar and accessories, for the purpose of approving colors and finish.

D. Build mock-ups to comply with the following requirements, using materials indicated for final unit of Work.
   1. Locate where directed.
   2. Coordinate with work of other Sections.
   3. Mock-up may not remain as part of the Work.
   4. Protect mock-ups from the elements with weather-resistant membrane.
   5. Retain and maintain mock-ups during construction in undisturbed condition as standard for judging completed unit masonry construction.

6. When directed, demolish and remove mock-ups from Project site.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Store cementitious materials and insulation off the ground, under cover, and in dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.

E. Store water repellents in strict accordance with manufacturer's written recommendations, off of ground, under cover, and otherwise as required to protect from damage, contamination, etc.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530.1/ASCE 6/TMS 602 or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depths as indicated on drawings for specific locations. Furnish 8 inch deep units if depth is not indicated on the drawings.
   2. Special Shapes: Provide non-standard blocks configured for corners, lintels, headers, control joint edges, bonding, and other detailed conditions.
      a. Outside Corner Units: Provide square edged units for outside corners unless otherwise indicated.
      b. Provide one quarter notched foundation block and other preformed shapes, if any, as indicated on the drawings.
   3. Load-Bearing Units: ASTM C90, normal weight.
      a. Hollow block, as indicated.
      b. Unit Compressive Strength: Provide units with minimum average net area compressive strength of 1,900 psi.
      c. Weight Classification at Above Grade Locations: Lightweight, except provide Normal Weight units where required to achieve required fire-ratings according to manufacturer's testing and/or by "calculated fire resistance" as may be allowed by applicable building code.
      d. Exposed Faces: Manufacturer's standard color and texture where indicated.
   4. Nonloadbearing Units: ASTM C129.
      a. Hollow block, as indicated.
      b. Lightweight.
      c. Unit Compressive Strength: Provide units with minimum average net area compressive strength of 1,900 psi.
   5. Units with Integral Water Repellent: Concrete block units as specified in this section with polymeric liquid admixture added to concrete masonry units at time of manufacture.
      a. Performance of Units with Integral Water Repellent:
         1) Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours.
            (a) No water visible on back of wall above flashing at the end of 24 hours.
            (b) No flow of water from flashing equal to or greater than 0.032 gallons per hour (0.05 L per hour) at the end of 24 hours.
            (c) No more than 25 percent of wall area above flashing visibly damp at end of test.

2) Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
3) Compressive Strength: ASTM C1314; maximum 5 percent decrease.

b. Use only in combination with mortar that also has integral water repellent admixture.
c. Use water repellent admixtures for masonry units and mortar by a single manufacturer.

2.02 BRICK UNITS

A. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
1. Color and texture: To be selected by Architect after bidding, from products complying with allowance amounts in Section 01 2100 - Allowances.
2. Size: Brick size to be modular, unless noted otherwise.
3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
4. For sills, caps and similar applications resulting in exposure to brick surfaces which otherwise would be concealed from view, provide uncored or unfrogged units with all exposed surfaces by sawing.

2.03 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91.
1. Colored Mortar: Premixed cement as required to match Architect's color sample.
2. Colored mortar: To be selected by Architect after bid date for all locations indicated on the Drawings, within Allowance amount in Section 01 2100 - Allowances. Color to be selected from manufacturers standard formulations of at least 15 selections, unless indicated otherwise.

B. Portland Cement: ASTM C150/C150M, Type I or II; color as required to produce approved color sample.
1. Not more than 0.60 percent alkali.

C. Hydrated Lime: ASTM C207, Type S.

D. Mortar Aggregate: ASTM C144.

E. Grout Aggregate: ASTM C404.

F. Water: Clean and potable.

G. Accelerating Admixture: Nonchloride type for use in cold weather.

H. Water Repellent and Efflorescence Control Mortar Admixture, approved by mortar manufacturer: Water repellent and efflorescence-control mortar admixture demonstrating resistance to moisture migration and wind-driven rain per ASTM E 514.
1. Acceptable product: "MasterPel 240MA" as manufactured by Master Builders Solutions, of BASF Corporation.
a. Substitutions: See Section 01 6000 - Product Requirements.
2. Extent of water repellent admixture: For use in face brick mortar. (Not for CMU mortar.)

2.04 REINFORCEMENT AND ANCHORAGE

A. Manufacturers:
1. Dur-O-Wal: www.dur-o-wal.com.
2. Hohmann & Barnard, Inc: www.h-b.com/#sle.
3. Sandell and Diedrich: www:sandellmfg.com.
4. WIRE-BONDwww.wirebond.com/#sle.

B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa), deformed billet bars; uncoated.

C. Single Wythe Joint Reinforcement: Truss or ladder type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage on each exposure.

D. Adjustable Multiple Wythe Joint Reinforcement: Truss type with adjustable ties or tabs spaced at 16 in (406 mm) on center and fabricated with moisture drip; ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/153M, Class B; 0.1875 inch (4.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods and adjustable components of 0.1875 inch (4.8 mm) wire; width of components as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage from each masonry face.
   1. Vertical adjustment: Not less than 2 inches (50 mm).

E. Concrete frame: Dovetail anchors of bent steel strap, nominal 1 inch (25 mm) width x 0.024 in (0.61 mm) thick, with trapezoidal wire ties 0.1875 inch (4.75 mm) thick, hot dip galvanized to ASTM A 153/A 153M, Class B.

F. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch (6.3 mm) thick, with trapezoidal wire ties 0.1875 inch (4.75 mm) thick, hot dip galvanized to ASTM A 153/A 153M, Class B.

G. Steel frame (For anchoring cast stone to frame): Sheet metal plate, 3/4 inch x 6 inch long for welding to frame, 0.105 mm thick equal to H-B 359-FH, with trapezoidal wire ties 0.1875 inch (4.75 mm) thick, hot dip galvanized to ASTM A 153/A 153M, Class B.

H. Masonry Veneer Anchors: 2 piece adjustable veneer anchor for cavity wall construction, to accommodate board insulation. Hot dip galvanized. Consists of L-shaped plate with holes for connecting screws and pintle insertion. Equal to HB-213 for metal stud construction, and HB-5213 for concrete, CMU or brick backup.

I. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
   1. Anchor plates: Not less than 0.075 inch (1.91 mm) thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
   2. Wire ties: Manufacturer's standard shape, 0.1875 inch (4.75 mm) thick.
   3. Vertical adjustment: Not less than 3-1/2 inches (89 mm).

J. Anchor Bolts: Steel bolts complying with A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations, as indicated on the Drawings, or if not indicated, as required for the intended use:
   1. Headed bolts.
   2. Nonheaded bolts, straight.
   3. Nonheaded bolts, bent in manner indicated.

2.05 FLASHINGS

A. Self-adhered, rubberized asphalt/polyethylene flashing membrane for cavity wall applications.
   1. Self-adhesive cold applied membrane consisting of 0.8 mm(32 mils) of rubberized asphalt integrally bonded to a 0.2 mm (8mil) high density, cross laminated polyethylene film.
      a. Thickness: 1mm (40 mils).
      b. Rolls should be inter-wound with disposable silicone-coated release sheet.
      c. Provide required companion surface conditioner product, and all other materials and components recommended by flashing manufacturer.
   2. Product/Manufacturer:
      a. "CCW-705-TWF"; Carlisle Coatings & Waterproofing, Inc.: www.carlisle-ccw.com.
      b. "Polyguard 400 Thru Wall Flashing"; Polyguard Products, Inc.: www.polyguardproducts.com.
      c. "Perm-A-Barrier Wall Flashing"; W.R. Grace & Co.-Conn., Atlanta, GA: www.na.graceconstruction.com.
      d. "Textroflash Flashing"; Hohmann & Barnard, Inc.
   3. Application: Use at stud backup locations where flashing is fully concealed in masonry, including in part, wall flashing, below sills, at lintels and heads of openings, above grade weeps at base of exterior walls, etc.

a. Termination of membrane at dampproofed backup wall must occur 8" above mortar drainage medium, or approximately 16" above shelf angle. Termination shall be accomplished using termination bar specified below.
1) Termination bar shall be encapsulated with sealant compatible with water/air barrier coating. Acrylic latex sealant shall not be used.

B. Stainless Steel Flashing: Type 304, soft temper; 24 gauge, 0.0250 inches thick for through-wall applications; 26 gauge otherwise; finish 2B to 2D. Comply with ASTM A 666.
1. Shop-fabricated Metal Flashing (typical below parapet caps and all other tops of walls exposed at the exterior of building and other locations on site), covered with self-adhering flashing to make watertight.
2. Low-profile concealed through-wall sheet metal flashing, fabricated with ribs at 3-inch intervals along length of material, to provide an integral bond with solid mortar bedding at each side.
3. Height: 3/8-inch.
4. Width: 1-inch less than wall thickness (set in-place 1/2-inch back from each exterior wall face).
5. Product: Shop-fabricated stainless steel, fabricated to specific project requirements. Cover with self-adhered, rubberized asphalt flashing for cavity wall application.
6. Location: Masonry cavity flashing at relief angles and as noted.
a. Waterproofing membrane shall terminate onto stainless steel pan. Termination shall be a minimum of 1" back from face of exterior masonry wall.
b. Stainless steel flashing shall be end-dammed at termination between through-wall flashing and dissimilar systems.
c. Provide minimum 2" tall back dams, and minimum 2" tall end dams.

2.06 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
1. Manufacturers:
a. Dur-O-Wal: www.dur-o-wal.com.
b. Hohmann & Barnard, Inc: www.h-b.com/#sle.
c. WIRE-BOND: www.wirebond.com/#sle.

B. Joint Filler: Closed cell rubber; oversized 50 percent to joint width; self expanding; in maximum lengths available.
1. Manufacturers:
a. Dur-O-Wal: www.dur-o-wal.com.
b. Hohmann & Barnard, Inc: www.h-b.com/#sle.
c. Sandell and Diedrich: www:sandellmfg.com.
d. WIRE-BOND: www.wirebond.com/#sle.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage. 18" high.
1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
a. Manufacturers:
1) Advanced Building Products Inc; Mortar Break II: www.advancedflashing.com/#sle.
2) CavClear/ Archovations, Inc.; "Masonry Mat": www.cavclear.com.
3) Mortar Net Solutions; MortarNet: www.mortarnet.com/#sle.
4) "Polyguard Mortar Deflector"; Polyguard Products, Inc.: www.polyguardproducts.com.
5) Sandell Construction Solutions; "Mortar Web": www.sandellmfg.com.
6) Substitutions: See Section 01 6000 - Product Requirements.

b. Location: At the bottom of all masonry drainage cavities, where indicated, and wherever the masonry drainage cavity is interrupted by relief angles, windows, door, or other interruptions. Also provide full height at masonry to flashing conditions at window and door jambs, as indicated.

D. Building Paper: ASTM D226/D226M, Type I ("No.15") asphalt felt.

E. Termination Bar: Stainless steel bar designed to terminate and seal top of flashing in cavity wall. Bar shall be flat and shall have pre-drilled holes 8" o.c. for attachment to substrate with appropriate non-corrosive fasteners. Bar shall be 3/4" wide by 1/8" thick.
1. Termination bar shall be encapsulated with compatible sealant. Note: The sealant shall be compatible with the water/air barrier coating, and shall be compatible with the waterproofing membrane and adhesives. (Acrylic latex sealant shall NOT be used.)

F. Weeps: ectangular plastic with cotton rope and screens.
1. Color(s): As indicated on drawings.
2. Manufacturers:
a. CavClear, a Division of Archovations Inc; _____: www.cavclear.com/#sle.
b. Mortar Net Solutions: www.mortarnet.com/#sle.
c. Sandell and Diedrich: www:sandellmfg.com.
d. Substitutions: See Section 01 6000 - Product Requirements.

G. Cavity Vents:
1. Type: Molded PVC grilles, insect resistant.
2. Color(s): As selected by Architect from manufacturer's full range.
3. Extent: At top course of masonry, at each end of precast header, and as noted.
4. Manufacturers:
a. CavClear, a Division of Archovations Inc; _____: www.cavclear.com/#sle.
b. Hohmann & Barnard, Inc; _____: www.h-b.com/#sle.
c. Mortar Net Solutions: www.mortarnet.com/#sle.
d. Sandell and Diedrich: www:sandellmfg.com.

H. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.07 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
1. Masonry below grade and in contact with earth: Type M.
2. Exterior, loadbearing masonry: Type S.
3. Exterior, non-loadbearing masonry: Type N.
4. Interior, loadbearing masonry: Type S.
5. Interior, non-loadbearing masonry: Type N.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).

D. Mixing: Use mechanical batch mixer and comply with referenced standards.

2.08 WATER REPELLENT

A. Provide from a company with minimum five years experience manufacturing water repellent, and by an applicator with minimum five years experience applying water repellent. Post-applied water repellent product shall be equivalent to “Siloxane PD” as manufactured by SureKlean Weather Seal, subsidiary of Prosoco: www.prosoco.com. One Coat, unless otherwise required by Architect, or recommended by Manufacturer.
1. Other Manufacturers/Products:
a. BASF; "Hydrozo 100": www.BuildingSystems.BASF.com.
b. Diedrich Technologies; "303S Siloxseal": www.diedrichtechnologies.com.

c. Substitutions: See Section 01 6000 - Product Requirements.
2. Submit for approval prior to application.
3. Include in Mock-Up walls for approval.
4. Application rate not to exceed product manufacturer's current written recommendations, but 100% coverage is required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of unit masonry, if any.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

D. Do not proceed until all unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

C. Mason is to coordinate with electrical, mechanical, plumbing, and any other trade that will have in-wall work, prior to starting of masonry work.

D. Where adjacent flooring is to receive concrete sealing or staining, or polishing and dyeing, provide minimum 1/2" plywood protection over floor, as described in Section 03 3543 –Concrete Polishing and Dyeing, or Section 03 3931 - Curing, Sealing, and Hardening Concrete Floors.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
1. Mix units from several pallets or cubes as they are placed.

3.05 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement type joints, returns, and offsets. Avoid the use of less than half size units at corners, jambs, and where possible at other locations.

D. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2-inches. Bond and interlock each course of each wythe at corners.

E. Stopping and Resuming Work: In each course, rack back 1/2 unit length in each course; do not tooth. Clean exposed surfaces of set masonry, wet masonry units lightly (if required), and remove loose masonry units and mortar prior to laying fresh masonry.

F. Built-In Work:
   1. As construction progresses, build-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.
   2. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
   3. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

G. Fill cores in hollow concrete masonry units with grout 3 courses (24-inches) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

H. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
   3. Mortar Joints: Concave.

I. Brick Units:
   1. Bond: Running.
   2. Coursing: Three units and three mortar joints to equal 8 inches (200 mm).
   3. Mortar Joints: Concave.

3.06 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses; both outside and inside the cavity.

E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

F. Interlock intersections and external corners. Do not use units with less than nominal 4 inch horizontal face dimensions at corners or jambs.

G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

I. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

J. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

K. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.07 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches (600 mm) on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

B. Install cavity vents in veneer and cavity walls at 32 inches (800 mm) on center horizontally below shelf angles and lintels and near top of walls.

3.08 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
   1. Contractor is to keep cavity clean of mortar droppings and not allow for excessive mortar into the cavity.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.09 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide concrete unit masonry that develops the following installed compressive strengths (f'm): f'm = 1,500 psi.

3.10 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches (150 mm).

E. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches (400 mm) on center.

F. Embed tie section in masonry joints. Provide not less than 1 inch air space between back of masonry veneer wythe and face of sheathing.

3.11 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

A. Install horizontal joint reinforcement 16 inches (400 mm) on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches (150 mm).

E. Reinforce joint corners and intersections with strap anchors 16 inches (400 mm) on center.

3.12 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches (400 mm) on center vertically and 32 inches (800 mm) on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.

B. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches (400 mm) on center vertically and 16 inches (400 mm) on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.

3.13 REINFORCEMENT AND ANCHORAGES - CAVITY WALL MASONRY

A. Install horizontal joint reinforcement 16 inches (400 mm) on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of openings.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches (150 mm).

E. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Space anchors at maximum of 24 inches (600 mm) horizontally and 16 inches (400 mm) vertically.

F. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches (400 mm) on center.

3.14 MASONRY FLASHINGS

A. Install flashings in accordance with Drawings, approved shop drawings, and manufacturer's recommended installation instructions.

B. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches (152 mm), minimum, into adjacent masonry or turn up flashing ends at least 8 inches (203 mm), minimum, to form watertight pan at non-masonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing with approved mastic or approved equivalent before covering with mortar.

C. Prepare masonry surfaces so that they are smooth and free from projections that could puncture flashing. Place flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with adhesive/sealant/tape, as recommended by flashing manufacturer before covering with mortar.
   1. Where indicated or required by manufacturer, provide continuous seal at top edge, using their recommended materials.

D. Cover all flashing splices with a third piece of flashing, fully bedded in medium modulus silicone such as Dow 795, Tremco Spectrem 2, Pecora 895, or approved equal.

E. Extend metal flashings through exterior face of masonry and turn down to form drip. Install joint sealer below drip edge to prevent moisture migration under flashing.

F. Extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 8 inches on back-up wall (at stud walls), and seal top edge with termination bar and sealant; except turned up a minimum of 8 inches at back-up masonry walls and extended through back-up wall to within 1/2-inch of its interior face.

G. At heads and sills, extend flashing as specified above unless otherwise indicated, but turn up ends not less than 2 inches to form a pan.

H. Lap end joints of flashings at least 6 inches (152 mm), minimum, and seal watertight with flashing sealant/adhesive.

I. Install stainless steel metal drip edge when using flexible flashing.

J. Prior to starting the installation of flashing, an in-place mock-up will be required.

K. Coordinate step flashing with roof installer.

3.15 LINTELS

A. Install galvanized loose steel lintels over openings.

B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
   1. Openings to 42 inches (1070 mm): Place two, No. 3 (M9) reinforcing bars 1 inch (25 mm) from bottom web.
   2. Openings from 42 inches (1070 mm) to 78 inches (1980 mm): Place two, No. 5 (M16) reinforcing bars 1 inch (25 mm) from bottom web.
   3. Openings over 78 inches (1980 mm): Reinforce openings as detailed.
   4. Do not splice reinforcing bars.
   5. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
   6. Place and consolidate grout fill without displacing reinforcing.
   7. Allow masonry lintels to attain specified strength before removing temporary supports.

C. Maintain minimum 8 inch (200 mm) bearing on each side of opening.

3.16 GROUTED COMPONENTS

A. Lap splices minimum 24 bar diameters.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.

C. Place and consolidate grout fill without displacing reinforcing.

D. At bearing locations, fill masonry cores with grout for a minimum 12 inches (300 mm) either side of opening.

3.17 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints. Install control and expansion joints in unit masonry where existing in floor slabs, walls, and roof, and as otherwise indicated. Build in related items as the masonry progresses.

B. Horizontal bond beams and reinforcing shall continue through vertical masonry control joints.

C. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant. Use firestop materials at fire-rated walls, as specified.

D. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

E. Provide control joints at locations indicated or as approved by Architect, and not to exceed the following at continuous straight runs:
   1. Exterior and Interior Walls: 25'-0" o.c. maximum along continuous runs of brick masonry.
   2. Walls of concrete masonry units: 25'-0" o.c. maximum along continuous runs of CMU, unless indicated otherwise.
   3. Also provide control joints at inside corners, and within 2'-0" of outside corners.

F. Size control joint in accordance with Section 07 9005 for sealant performance.
   1. Joint width: 3/8" up to 16' spacing; 1/2" for 16'-22' spacing, and 5/8" for 22'-30' spacing.
   2. Joints shall be clear of mortar. Seal with silicone sealant, with optional compressible joint filler.

3.18 WATER REPELLENTS

A. Apply water repellents to all exterior masonry, unless scheduled to receive a coating under another division, after thorough cleaning and rinsing, prior to any backfill or any other concealment.

B. Install in strict accordance with manufacturer's current written instructions and recommendations. Test for application rate.

C. Thoroughly clean and rinse all masonry prior to application of water repellents, water-proofing, coatings, paint, etc. Comply with written recommendations of each manufacturer of products to be applied to masonry work.

3.19 BUILT-IN WORK

A. As work progresses, install built-in metal door frames, glazed frames, fabricated metal frames, window frames, anchor bolts, and plates and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
   1. Fill adjacent masonry cores with grout minimum 12 inches (300 mm) from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.20 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.

C. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).

E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).

F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

G. Maximum Variation for Vertical Alignment of Head Joints: 1/4 inch in 10 ft, 1/2" maximum.

3.21 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.22 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.

C. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

D. Use Volume Boxes.

3.23 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.
   1. Clean glass unit masonry as work progresses. Remove mortar fins and smears immediately, using a clean, wet sponge or a scrub brush with still fiber bristles. Do not use harsh cleaners, acids, abrasives, steel wool, or wire brushes when removing mortar or cleaning glass unit masonry.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings, and adjacent construction to provide a neat, uniform appearance, prepared for application of sealants.

C. Remove all efflorescence from concrete masonry units, exposed and not exposed. Ensure that all masonry walls are dry prior to installation of air and water barriers or other finish materials.

D. Remove excess mortar and mortar droppings. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.

E. Replace defective mortar. Match adjacent work.

F. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Saturate wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean brick by means of bucket and brush hand-cleaning method described in BIA "Technical Note No. 20 Revised", to clean brick masonry made of clay or shale, except use detergent as the masonry cleaner.
6. Clean concrete masonry by means of cleaning method indicated in NCMA TEK 45 applicable to type of stain present on exposed surfaces.
7. Comply with masonry manufacturer's instructions.

3.24 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

B. Protection of Masonry:
   1. During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   2. Extend cover a minimum of 24-inches down both sides and hold cover securely in place.
   3. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24-inches down face next to unconstructed wythe and hold cover in place.

C. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

D. Stain Prevention:
   1. Prevent grout, mortar, and soil from staining the face of masonry to be left exposed, painted, and/or to receive any other coatings. Remove immediately any grout, mortar, and soil that come in contact with such masonry.
   2. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface, until landscaping or other improvements indicated adjacent to completed masonry work are in place.
   3. Protect sills, ledges, and projections from mortar droppings.
   4. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes from mortar droppings, coatings, water repellents, and/or any other damage.

END OF SECTION

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SECTION 04 7200
CAST STONE MASONRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Architectural Cast Stone.

B. Units Required are running bond walls, sills, banding, and other custom shapes as indicated.

C. Architectural Precast Concrete.

D. Water Repellents.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of Contract, including General Conditions and Division 1 Specification Sections, apply to the work of this Section.

B. Section 04 2000 - Unit Masonry: Installation of cast stone in conjunction with masonry.

C. Section 07 6200 - Sheet Metal Flashing and Trim: Flashing, Vents and Masonry Accessories.

D. Section 07 9005 - Joint Sealers: Materials and execution methods for sealing soft joints in cast stone work.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2026.

C. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2024.

D. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2022.

E. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.

F. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.

G. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2025b.

H. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2024.

I. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2024.

J. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2025.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.

C. Product Data: Test results of cast stone components made previously by the manufacturer.
   1. Include one copy of ASTM C1364 for Architect's use.

D. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.
   1. Anchoring design shop drawings shall include design engineer's stamp or seal and signature on each sheet, certifying attachment details, anchorage, and size and shape of fasteners are in conformance with all State and local codes and regulations.

E. Mortar Color Selection Samples.

F. Samples, For Review:

1. Basic Shapes: One of each, not less than 8 inches long. For selection of color, texture and shape.
2. Accent, Trim and Specialty Shapes: One of each.

G. Verification Samples: Pieces of actual cast stone components not less than 8 inches (___ mm) long, illustrating range of color and texture to be anticipated in components furnished for the project.

H. Full-Size Samples: One unit of each shape, for review. Make available for Architect's review at Project site.

I. Mortar Color Verification Samples.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. A firm with a minimum of 5 years experience producing cast stone of types required for project.
2. Current producer member of the Cast Stone Institute or the Architectural Precast Association with a minimum of 10 years experience in producing cast stone of the types required for the project.
3. Manufacturer's production facility currently holds a Plant Certification from the Cast Stone Institute or the Architectural Precast Association.
4. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.
5. Manufacturer shall have an internal Quality Assurance Testing Program with Certified Laboratory Technician.
6. Obtain cast stone units through one source from a single manufacturer.

B. Professional Engineer Qualifications: Professional engineer experienced in design of this work and licensed in the state in which the project is located, or personnel under direct supervision of such an engineer.

C. Single-Source Responsibility: Obtain cast stone units and architectural precast products from a single manufacturer. The purpose of this is to guarantee that color and texture of such products is the same.

D. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

E. Single-Source Responsibility for Water Repellents: Obtain each type of integral and applied water repellents from a single manufacturer for the entire project.
1. Verify full compatibility with any other coatings, fluid applied waterproofing, etc., prior to application of this and other products. Notify Architect in writing and in detail, of any incompatible products, prior to any application, and await Architect's written direction on how to proceed.

1.06 MOCK-UP

A. Include cast stone masonry in Mock-Up as described in Section 01 4000 - Quality Requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Schedule and coordinate production and delivery of architectural cast stone products with unit masonry work.

B. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.
1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining.
2. Provide itemized shipping list.

C. Number each piece individually to match shop drawings and schedule.

D. Store cast stone components and installation materials in accordance with manufacturer's instructions.

E. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt and splashing.

F. Protect cast stone components, including corners and edges, during storage, handling and installation to prevent chipping, cracking, staining, or other damage.

G. Handle long units at center and both ends simultaneously to prevent cracking.

H. Do not use pry bars or other equipment in a manner that could damage units.

I. Store mortar materials where contamination can be avoided.

J. Stained or damaged units will not be accepted and will be replaced at the Contractor's expense.

K. Schedule and coordinate production and delivery of architectural cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

2.02 ARCHITECTURAL CAST STONE

A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural limestone, complying with ASTM C1364.
   1. Casting Method: Vibrant dry hand tamp or wet cast as required.
   2. Compressive Strength: ASTM C 1194: Minimum 6,500 psi at 28 days.
   3. Absorption, ASTM C 1195: Maximum 6 percent, by cold water method, at 28 days.
   4. Linear Shrinkage, ASTM C 426: Less than 0.065 percent.
   5. Density, ASTM C 140: Greater than 120 pounds per cubic foot.
   6. Freeze-Thaw, ASTM C 666: Less than 5 percent cumulative mass loss after 300 cycles.
   7. Air Content: ASTM C 173 or C 231 for wet cast product shall be 4-8 percent for units exposed to freeze-thaw environments; air entrainment is not required for VDT products.
   8. Remove cement film from exposed surfaces before packaging for shipment.

B. Shapes: Provide shapes indicated on drawings.
   1. Variation from any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch (3 mm) or length divided by 360, whichever is greater, but not more than 1/4 inch (6 mm).
   2. Unless otherwise indicated on drawings, provide:
      a. Wash or slope of 1:12 on exterior horizontal surfaces.
      b. Drips on projecting components, wherever possible.
      c. Raised fillets at back of sills and at ends to be built in.
   3. Bed Depth: 3-5/8 inches, unless indicated otherwise.

C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI CODE-318.
   1. Pieces More than 24 inches (610 mm) in Any Dimension: Provide full length two-way reinforcement of cross-sectional area not less than 0.25 percent of unit cross-sectional area.

2.03 MATERIALS

A. Portland Cement: ASTM C150/C150M.
   1. For Units: Type I, white or gray as required to match Architect 's sample.
   2. For Mortar: Type I or II, except Type III may be used in cold weather.

B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.

C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.

D. Pigments: ASTM C979, inorganic iron oxides; do not use carbon black.

E. Admixtures: ASTM C494/C494M.
   1. Water Reducing, Retarding, and Accelerating Admixtures: ASTM C 494.
   2. ASTM C 260 for air-entraining admixtures.
   3. Integral Water Repellant, approved by cast stone manufacturer: Integral water repellent and efflorescence control admixture demonstrating resistance to wind-driven rain per ASTM E 514:
      a. Acceptable product: "Rheopel Plus" Water Repellent and Efflorescence Control Admixture, as manufactured by Master Builders, of BASF Construction Chemicals, LLC.
   4. ASTM C 618 for mineral admixtures.
   5. ASTM D 989 for ground granulated blast-furnace slag.
   6. Other Admixtures For which no ASTM standard exists, shall be previously established as suitable for use in concrete by proven field performance or through laboratory testing.

F. Water: Potable.

G. Reinforcing Bars: ASTM A615/A615M deformed bars, epoxy coated or galvanized when covered with less than 1-1/2 inches of material.
   1. Galvanized in accordance with ASTM A767/A767M, Class I.
   2. Epoxy coated in accordance with ASTM A775/A775M.

H. Steel Welded Wire Reinforcement: ASTM A 185/A 185M, galvanized or epoxy coated.

I. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions. Cast stone supplier is responsible for supplying all necessary anchors.

J. Shelf Angles and Similar Structural Items: Hot-dip galvanized steel per ASTM A123/A123M, of shapes and sizes as required for conditions.

K. Mortar: Portland cement-lime, ASTM C270 Type N ; do not use masonry cement.

L. Sealant, and backer rods: As specified in Section 07 9005.

M. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

2.04 ACCESSORIES

A. Bond Breaker: 6-mil polyethylene.

B. Water Repellent: Product with UV sensitive/fugitive dye, in water carrier; or equal product, approved by cast stone manufacturer. Water repellent manufacturer shall provide certification that water repellent is compatible with cast stone and other (integral) water repellents used. Application: One coat, unless otherwise required to obtain complete coverage.
   1. Application rate not to exceed product manufacturer's current written recommendations, but 100% coverage is required.
   2. Submit for approval prior to application.

C. Cavity Vents: Plastic tubes with brass or stainless steel screens. Spaced 3'-4" o.c., unless noted otherwise.
   1. Manufacturers:
      a. Advanced Building Products, Inc. "Mortar Maze Weep Tubes"; www.advancedflashing.com.
      b. Hohmann & Barnard, Inc; "341S": www.h-b.com/sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

D. Weeps: Plastic tubes with cotton rope and brass or stainless steel screens. Spaced 2' o.c., unless noted otherwise.
   1. Manufacturers:
      a. Advanced Building Products, Inc. "Mortar Maze Weep Tubes"; www.advancedflashing.com.

b. Hohmann & Barnard, Inc; "341W/S": www.h-b.com/sle.
c. Substitutions: See Section 01 6000 - Product Requirements.

2.05 TOLERANCES

A. General: Manufacture cast stone units within tolerances in accordance with Cast Stone Institute Technical Manual, unless otherwise specified.

B. Cross Section Dimensions: Do not deviate by more than plus or minus 1/8 inch from approved dimensions.

C. Length of Units: Do not deviate by more than length/360 or plus or minus 1/8 inch, whichever is greater, not to exceed plus or minus 1/4 inch.

D. Warp, Bow, or Twist: Do not exceed length/360 or plus or minus 1/8 inch, whichever is greater.

2.06 FINISHES

A. General: Smooth. Match texture and color of full-size sample on file with Architect.

B. Texture of surfaces exposed to view:
1. Fine-grained texture similar to natural stone.
2. Approximately equal to approved sample when viewed in direct daylight at 10 feet.

C. Surface Air Voids:
1. Size: Maximum 1/32 inch.
2. Density: Less than 3 occurrences per any 1 square inch.
3. Viewing Conditions: Not obvious under direct daylight at 10 feet.

D. Color:
1. Match Architect's sample.
2. Color Variation:
a. Viewing Conditions: Compare in direct daylight at 10 feet, between units of similar age, subjected to similar weathering conditions.
b. Total Color Difference: ASTM C 1364, 6 units.
c. Hue Difference: ASTM C 1364, 2 units.

E. Chipping:
1. Minor chipping: Chips which are not obvious in direct daylight at 20 feet.
2. Chipping which exceeds definition of minor chipping, as determined by Architect, shall be grounds for rejection of units.

2.07 SOURCE QUALITY CONTROL

A. Plant Production Testing: Test compressive strength and absorption from specimens selected at random from plant production. Tests to be conducted by certified laboratory testing technicians.
1. Custom Cast Stone Units: Test in accordance with ASTM C 1194 and C 1195.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.

B. Do not begin installation until unacceptable conditions have been corrected.

C. Examine cast stone units before installation. Do not install unacceptable units.

3.02 INSTALLATION

A. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 2000.
1. Use masonry wall ties specified in Section 04 2000 - Unit Masonry.
2. Pull units from multiple cubes during installation to minimize variation in color and help with natural blending.

3. Cut units using motor-driven masonry saws. Turn finished ends to the visible side and turn the saw cut to the inside of the mortar joints to hide exposed aggregates and saw marks.
4. Avoid use of pry bars or other equipment in a manner that could damage units.

B. Setting:
1. Set units in a full bed of mortar unless otherwise indicated.
2. Fill vertical joints with mortar.
3. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.03 REPAIR

A. Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet (6 m).

B. Repair with matching touch-up material provided by the manufacturer and in accordance with manufacturer's instructions.

C. Repair methods and results to be approved by Architect.

D. Units that cannot be repaired satisfactorily shall be replaced.

3.04 CLEANING

A. Clean completed exposed cast stone after mortar is thoroughly set and cured.

B. Perform test of cleaner on small area of 4 feet by 4 feet on each type and color and receive approval by Architect before full cleaning. Let test area dry 4 to 5 days before inspection. Keep test area for future comparison.

C. Wet surfaces with water before applying cleaner.

D. Apply cleaner to cast stone in accordance with manufacturer's instructions.

E. Brush on cleaner, let dwell for 2 to 3 minutes. Reapply cleaner, scrub surface with masonry brush and rinse off thoroughly. Areas with heavy soiling use a wood block or non-metallic scraper.

F. Remove cleaner promptly by rinsing thoroughly with clear water.

G. Do not use acidic cleaners, power washing, sandblasting, or harsh cleaning materials or methods that would damage or discolor surfaces.

3.05 PROTECTION

A. Protect completed work from damage.

B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION

SECTION 05 1200

STRUCTURAL STEEL

PART 1 – GENERAL

1.1 SUMMARY:

A. Section Includes:

1. Structural steel work including schedules, notes and details showing size and location of members, typical connections, and type of steel required.
2. Structural steel is that work defined in American Institute of Steel Construction (AISC) "Code of Standard Practice" and as otherwise shown on drawings.
3. Related work specified elsewhere:
   a. Miscellaneous Metal Fabrications are specified elsewhere in Division 5
   b. Refer to Division 3 for anchor bolt installation in concrete, Division 4 for anchor bolt installation in masonry.

B. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 05 5000, "Metal Fabrications": Loose steel bearing plates and miscellaneous steel framing.

1.2 PERFORMANCE REQUIREMENTS:

A. Structural Performance: Engineer structural steel members and connections required by the Contract Documents to be selected or completed by the fabricator to withstand design loadings indicated.

B. Design of Members and Connections: Details shown are typical, similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.

1.3 SUBMITTALS:

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

1. Submit all shop drawings on one reproducible print (sepia) and two blue line prints only. The reproducible print will be returned. All blue line prints required by the contractor are the responsibility of the Contractor and shall be made after reproducible is returned.

B. Product Data or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards). This data is submitted for information only.

1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.
2. High-strength bolts (each type), including nuts and washers.
   a. Include Direct Tension Indicators if used.
3. Structural steel primer paint.
4. Shrinkage-resistant grout.
5. Welder's certificates
6. Submit evidence of fabricator and erector qualifications.

C. Shop Drawings prepared under the supervision of, signed and sealed by a Licensed Professional Engineer, including complete details and schedules for fabrication and assembly of structural steel members, procedures and diagrams.

1. Include details of cuts, connections, camber, holes, and other pertinent data.
2. Welds: Indicate welds by standard AWS A2.1 and A2.4 symbols. Distinguishing between shop and field welds, and show size, length, and type of each weld.
3. Bolts: Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.
4. Setting Drawings: Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorage's to be installed by others.
5. Erection Drawings: Prepare and furnish to the Architect for review, erection drawings, detailed shop drawings and connection design calculations for all structural steel. Manufacturing of any material or performing of any work before final review of shop drawings will be entirely at risk.
6. Contract documents shall not be used for shop drawing, including erection plans or details.
7. All shop drawings which are resubmitted for any reason shall have all revised items clouded or identified for each submittal.
8. Fabrication, assembly and erection shall conform to reviewed shop drawings.

D. Connection Calculations:

1. All structural steel connections not specifically detailed on the drawings shall be designed to resist forces indicated, by the Contractor, under the direct supervision of a professional engineer registered in the State of Alabama.
2. Design calculations for the connections designed by the Contractor shall be submitted for the files of the Architect and Engineer. Calculations shall bear the seal of a professional engineer registered in the State of Alabama. Shop drawings containing connections for which calculations have not been received will be returned unchecked as an incomplete submittal.
3. For each connection, the following shall be noted on the shop drawings:
4. Required design reaction.
5. Calculation sheet number for design.
6. Capacity of detailed connection.

E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.

1. Structural steel, including chemical and physical properties.
2. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Shear stud connectors.
5. Shop primers.
6. Nonshrink grout.

1.4 QUALITY ASSURANCE:

A. Erector Qualifications: Engage an experienced Erector who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

C. Codes and Standards: Comply with provisions of following, except as otherwise indicated:

1. AISC's "Specification for Structural Steel Buildings—Allowable Stress Design and Plastic Design."
2. AISC's "Load and Resistance Factor Design (LFRD) Specification for Structural Steel Buildings."
3. AISC "Specifications for Structural Steel Buildings, Section 10, Architecturally Exposed Structural Steel."
4. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
5. AISC's "Specification for Load and Resistance Factor Design of Single-Angle Members."
6. AISC's "Seismic Provisions for Structural Steel Buildings."
7. American Institute of Steel Construction (AISC) "Code of Standard Practice for Steel Buildings and Bridges", dated June 10, 1992
   a. General:AISC "Code of Standard Practice" shall apply except to the extend that references are made to the responsibility of the Owner and/or Architect or Engineer in which event those references shall have no applicability. Where a conflict exists between the Code of Standard Practice and the Contract Documents, the Contract Documents shall govern.
   b. Paragraph 3.1:Add the following: "3.1.8 Include in the bid price for the work structural steel members shown on drawings, but not identified as to size, section, and material grade by assuming sizes, sections, and material grades shown for similarly loaded members having approximately the same overall

length except on areas that are noted on the drawings as incomplete. Identify such members and their associated cost in the bid for the work".

c. Paragraph 3.3:Delete the first sentence, "In case of discrepancies between plans and specifications for buildings, the specifications govern", and insert the following in its place, "In case of discrepancies between drawings and specifications for buildings, the drawings govern".

d. Paragraph 3.4:In the first sentence, delete the phrase "and made to a scale not less than 1.8" to the foot".

e. Paragraph 5.1:Delete the first sentence, "When the fabricator receives 'released for construction' plans and specifications, the fabricator may immediately place orders for the material necessary for fabrication". and insert the following in its place "when the fabricator receives 'issued for structural steel mill order of wide flange beams, girders and columns only' plans and specifications, the fabricator may immediately place orders for the material necessary for fabrication". Delete the second sentence, "The contract documents must note any materials or areas which should not be ordered due to a design which is incomplete or subject to revision".

8. ASTM A 6 (ASTM A 6M) "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
9. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
10. Research Council on Structural Connections' (RCSC) "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code—Steel."

E. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification in the past year.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.6 SEQUENCING:

A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

1.7 TESTING SERVICES:

A. Provide the Testing Laboratory with the following:

1. A complete set of shop and erection drawings reviewed by the Architect.
2. Mill test reports, cutting lists, order sheets, material bills and welder's certificates.
3. Full and ample means and assistance for testing all material.
4. Proper facilities, including scaffolding, temporary work platforms, hoisting facilities, etc., for inspection of the work in the mills, shop and field.

B. Propose procedures, acceptable to the Architect, to correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements.

C. Provide additional tests, by the Quality Control Testing Laboratory, as may be necessary, to reconfirm any noncompliance of the original work, and as may be necessary to show compliance off corrected work.

PART 2 – PRODUCTS

2.1 STEEL MATERIALS:

A. Metal Surfaces, General: For fabrication of work that will be exposed to view, use only materials that are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and applying surface finishes.

B. Structural Steel Shapes, Plates, and Bars: As follows:

1. Carbon Steel: ASTM A 36 (ASTM A 36M).
2. High-Strength, Low-Alloy Columbium-Vanadium Steel: ASTM A 572 (ASTM A 572M), Grade 50.

C. Cold-Formed Structural Steel Tubing: ASTM A 500, Grade B.

D. Hot-Formed Structural Steel Tubing: ASTM A 501.

E. Steel Pipe: ASTM A 53, Type E or S, Grade B.

1. Finish: Black, except where indicated to be galvanized.

F. Connection Material: Unless noted otherwise on the drawings, stiffener plates, doubler plates, gusset plates and the connecting plates shall be the same grade of steel as members being connected.

1. Finish: Black, except where indicated to be galvanized.

G. Shear Connectors: ASTM A 108, Grade 1015 through 1020, headed-stud type, cold-finished carbon steel, AWS D1.1, Type B.

H. Anchor Rods, Bolts, Nuts, and Washers: As follows:

1. Unheaded Rods: ASTM A 36 (ASTM A 36M).

2. Headed Bolts: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel, hex-head bolts; and carbon-steel nuts.
3. Washers: ASTM A 36 (ASTM A 36M).

I. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain, uncoated.

J. Welding Electrodes: Comply with AWS requirements.

2.2 PRIMER:

A. Primer: SSPC-Paint 15, Type I, red oxide.

2.3 GROUT:

A. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application, and a 30-minute working time. Subject to compliance with requirements, provide one of the following:

1. High Performance (Non-Metallic):
   a. “Masterflow 928”; Master Builders.
   b. “Crystex”; L & M Const. Chemical Co.
2. Construction Grade (Non-Metallic):
   a. “Set Grout”; Master Builders.
   b. “Euco-NS Grout”; Euclid Chemical Co.
   c. “Duragrout”; L & M Const. Chemical Co.
   d. “Horn Non-Corrosive Non-Shrink Grout”; A.C. Horn, Inc.
   e. “588 Grout”; W.R. Meadows, Inc.
   f. “Five Stair Grout”; Five Star Products, Inc.

2.4 FABRICATION:

A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.

1. Camber structural steel members where indicated.
2. Identify high-strength structural steel according to ASTM A 6 (ASTM A 6M) and maintain markings until steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
6. Comply with fabrication tolerance limits of AISC’s “Code of Standard Practice for Steel Buildings and Bridges” for structural steel.
7. Piping and/or cracks in flanges or webs of all rolled shapes or plates are to be removed and welded solid by AISC procedures.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded.

C. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.

D. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's printed instructions.

E. Steel Wall Framing: Select true and straight members for fabricating steel wall framing to be attached to structural steel framing. Straighten as required to provide uniform, square, and true members in completed wall framing.

F. Welded Door Frames: Build up welded door frames attached to structural steel framing. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches (250 mm) o.c., unless otherwise indicated.

G. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.

1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.

H. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.

I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Shop weld shear connectors, spaced as shown, to beams and girders in composite construction. Use automatic end welding of headed stud shear connectors in accordance with manufacturer's printed instructions.

2.5 SHOP CONNECTIONS:

A. Simple Beam Connections: Standard double angle framed beam connections using bolts as specified.

1. Seated Beam Connections and Stiffened Seated Beam Connections shall not be used unless indicated on the drawings or unless Engineer approval is obtained to verify capacity of supporting member for the resulting eccentricity. The fabricator must verify and bear responsibility that the use of such connections does not interfere with architectural or MEP requirements.

B. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.

C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.

2.6 SHOP PRIMING:

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed-on fireproofing, [unless otherwise specified].
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:

1. SSPC-SP 2 “Hand Tool Cleaning.”

2.7 SOURCE QUALITY CONTROL:

A. Independent Testing and Inspecting Laboratory: Owner will engage an Independent Testing and Inspecting Laboratory to perform shop inspections and tests and to prepare test reports.

1. Testing laboratory will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
2. Provide testing laboratory with access to places where structural steel work is being fabricated or produced so required inspection and testing can be accomplished.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor’s expense, will be performed to determine compliance of corrected Work with specified requirements.

D. Shop-bolted connections will be tested and inspected according to RCSC’s “Specification for Structural Joints Using ASTM A325 or A 490 Bolts”.

E. In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing laboratory’s option.

1. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
2. Ultrasonic Inspection:ASTM E 164.

PART 3 –EXECUTION:

3.1 INSPECTION:

A. Before erection proceeds, and with the steel erector present, verify elevations of concrete [and masonry bearing surfaces] and locations of anchorage's for compliance with requirements.

B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION:

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

B. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

3.3 ERECTION:

A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.

B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
   a. Comply with manufacturer's instructions for proprietary grout materials.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.

2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection.

H. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS:

A. Install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.

B. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds ½ inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.

D. Shear Connectors:Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld shear connectors in field, spaced as shown, to beams and girders in composite construction. Use automatic end welding of headed stud shear connectors in accordance with manufacturer's printed instructions.

3.5 FIELD QUALITY CONTROL:

A. Testing Laboratory Responsibility: The Owner's Testing Laboratory will perform field inspections and tests on and to prepare test reports as follows:

1. Testing Laboratory shall also approve welding certificates. Contractor shall submit three (3) copies of welding certificates and procedures for each welder involved in the Work.
2. Testing Laboratory shall conduct and interpret tests, certificates and procedures and state in each report whether tested Work complies with or deviates from requirements.

B. Quantity of Required Inspections and Tests: Testing Laboratory shall perform the following inspections or tests:

1. Shop Bolted Connections: Inspect or test in accordance with AISC specifications. Inspect ten percent (10%) of all bolts, but not less than two (2) bolts of each connection.
2. Shop Welded Connections: Inspect ten percent (10%) of all welds, other than visual, but not less than one (1) weld at each connection.

C. Provide access for Testing Laboratory to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.

D. Deficiencies: Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

E. Field Inspections and Tests: check steel as received in the field for possible shipping damage workmanship, piece making and verification of required camber.

F. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

G. Field-Bolted Connections: Inspect in accordance with AISC specification.

1. For non-slip critical bolted connections (bearing-type), all connections shall be visually observed to assure that all bolts, nuts and washers are in place and that all plies of connection material have been drawn together. All bolts shall be verified to be snug tight only.
2. For slip critical bolted connections (friction-type), all connections shall be visually observed to assure that all bolts, nuts and washers are in place and that all plies of connection material have been drawn together. 50% of all bolts, but not fewer than 25% of the bolts in any one connection shall be tested to assure proper pretension in accordance with AISC specifications.
3. Bolts in slotted holes at expansion joints shall have nuts finger tight with threads damaged.

H. Field Welding: Inspect and test during erection of structural steel as follows:

1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
2. Perform visual inspection of all welds, including but not limited to fit-up, intermediate passes and final weld.
3. Perform tests of welds as follows:
   a. Magnetic Particle Inspection:ASTM E709; performed on root pass and on finished weld. Inspect 20% of the length of each fillet weld. Cracks or zones of incomplete inspected on less than 100% basis shall require inspection of 100% of that weld.
   b. Ultrasonic Inspection:ASTM E164. Perform on all full and partial penetration welds.

3.6 CLEANING

A. Touch up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils (0.038 mm).

B. Touch up Painting: Cleaning and touch up painting of field welds, bolted connections, and abraded areas of shop paint on structural steel are included in Section 09900, “Painting.”

END OF STRUCTURAL STEEL

SECTION 05 3100

STEEL DECK

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:

1. Steel roof deck.

B. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 05 1200, "Structural Steel": Shop-welded shear connectors.
2. Section 05 5000, "Metal Fabrications": Framing openings with miscellaneous steel shapes.
3. Section 05 2100, “Steel Joists”.
4. Section 07 8150, "Sprayed-On Fireproofing".
5. Section 09 9000, "Painting":
   a. Touch-up and repair painting of deck.
   b. Touch-up and repair of special deck coatings.

1.2 SUBMITTALS:

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Submit all shop drawings on one reproducible print (sepia) and one blue line print only. The reproducible print will be returned. All blue line prints required by the Contractor will be the responsibility of the Contractor and shall be made after reproducible is returned.

C. Product data for each type of deck, accessory, and product specified.

1. Provide test data for mechanical fasteners used in lieu of welding for fastening deck to supporting structures.

D. Shop drawings showing layout and types of deck panels, anchorage details, reinforcing channels, pans, cut openings, closure strips, deck openings, special jointing, accessories, and attachments to other construction.

E. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

F. Product test reports from qualified independent testing agencies evidencing compliance with requirements of the following based on comprehensive testing:

1. Mechanical fasteners.

G. Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence steel deck's compliance with the building code in effect for the Project.

1.3 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of the following codes and standards, except as otherwise indicated:

1. American Iron and Steel Institute (AISC), “Specification for the Design of Cold-Formed Steel Structural Members”.
2. American Welding Society (AWS), D1.3 “Structural Welding Code - Sheet Steel”.
3. Steel Deck Institute (SDI), ‘’Design Manual for Composite Decks, Form Decks and Roof Decks’’.

B. Installer Qualifications: Engage an experienced Installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code-Steel" and AWS D1.3 "Structural Welding Code-Sheet Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

D. Welded decking in place is subject to inspection and testing. Owner will bear expense of removing and replacing portions of decking for testing purposes if welds are found to be satisfactory. Remove work found to be defective and replace with new acceptable work.

E. Fire-Test-Response Characteristics: Where indicated, provide steel deck panels identical to those tested as part of an assembly for fire resistance per ASTM E 119 by a testing and inspection agency performing testing and follow-up services, that is acceptable to authorities having jurisdiction.

F. Fire-Resistance Ratings: As indicated by design designations listed in UL "Fire Resistance Directory," or by Warnock Hersey or another testing and inspecting agency.

G. Labeling: Identify steel deck with appropriate markings of applicable testing and inspecting agency.

H. Installation Tolerances: Conform to the installation tolerances specified in Part 3.

1.4 DELIVERY, STORAGE, AND HANDLING:

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1.5 COORDINATION:

A. Coordinate installation of sound-absorbing insulation strips in acoustic deck ribs with related units of Work specified in other Sections to ensure that the insulation is protected against damage from effects of the weather and other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Roof Deck:
   a. Vulcraft Div. of Nucor Corp.
   b. New Millennium Building Systems.
   c. Epic Metals Corp.
   d. Bowman Metal Deck Armco, Inc.
   e. Wiremold/Walker.
   f. Wheeling Corrugating Co., Div. of Wheeling-Pittsburgh Steel Corp.

2.2 ROOF DECK:

A. Steel Roof Deck: Fabricate panels without top-flange stiffening grooves conforming to SDI Publication No. 28 "Specifications and Commentary for Steel Roof Deck" and the following:

1. Galvanized-Steel Sheet: ASTM A 446, Grade A, G 60 (ASTM A 446M, Grade A, Z 180) zinc coated according to ASTM A 525 (ASTM A 525M).
2. Deck Profile:
   a. Type WR, wide rib. Vented deck at light gauge roof trusses.
3. Profile Depth:
   a. 1-1/2 inches.
4. Design Uncoated-Steel Thickness:
   a. 0.0295 inch.
5. Span Condition:
   a. Triple span or more.
6. Side Joints:
   a. Overlapped or interlocking seam at Contractor's option.

2.3 FABRICATION AND ACCESSORIES:

A. General: Form deck units in lengths of three or more spans, with flush, telescoped, or nested 2-inch laps at ends and interlocking or nested side laps, unless noted. End laps shall occur over a support.

B. Roof Deck Units: Provide deck configurations that comply with SDI "Specifications and Commentary for Steel Roof Deck".

C. Cant Strips: Fabricate cant strips of not less than 20 gage galvanized sheet steel of same quality as the deck units. Bend cant strips to form a 45 degree cant not less than 5 inches wide with top and bottom flanges not less than 2 inches wide, unless noted. Provide cant strips in 10 foot lengths where possible.

D. Ridge and Valley Plates: Fabricate ridge and valley plates of not less than 20 gage galvanized sheet steel of the same quality as deck units. Bend to provide tight-fitting closure with deck units. Each leg of bend shall not be less than 3 inches. Provide plates in 10 foot lengths where possible.

E. Accessories: Provide accessory materials for steel deck that comply with requirements indicated and recommendations of the steel deck manufacturer.

F. Mechanical Fasteners: Manufacturer's standard, corrosion-resistant, low-velocity, powder-actuated or pneumatically driven carbon steel fasteners; or self-drilling, self-threading screws.

G. Side Lap Fasteners: Manufacturer's standard, corrosion-resistant, hexagonal washer head; self-drilling, carbon steel screws, No. 10 (4.8 mm) minimum diameter.

H. Rib Closure Strips: Manufacturer's standard vulcanized, closed-cell, synthetic rubber.

I. Miscellaneous Roof Deck Accessories: Steel sheet, 0.0359-inch (0.91-mm) thick minimum ridge and valley plates, finish strips, and reinforcing channels, of same material as roof deck.

J. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material and thickness as deck panels, unless otherwise indicated.

K. Weld Washers: Manufacturer's standard uncoated-steel sheet weld washers, shaped to fit deck rib, 0.0598 inch (1.5 mm) thick with 3/8-inch (9.5-mm) minimum diameter prepunched hole.

L. Recessed Sump Pans: Manufacturer's standard size, single piece steel sheet 0.071-inch- (1.8-mm-) thick minimum, of same material as deck panels, with 1-1/2-inch- (38-mm-) minimum deep level recessed pans and 3-inch- (76-mm-) wide flanges. Cut holes for drains in the field.

M. Flat Receiver Pan: Manufacturer's standard size, single-piece steel sheet, 0.071-inch- (1.8-mm-) thick minimum units, of same material as deck panels. Cut holes for drains in the field.

N. Shear Connectors: ASTM A 108, Grade 1010 through 1020 headed stud type, cold-finished carbon steel, AWS D1.1, Type B.

O. Steel Sheet Accessories: ASTM A 446, G 60 (ASTM A 446M, Z 180) coating class, galvanized according to ASTM A 525 (ASTM A 525M).

P. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine supporting framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of steel deck.

3.2 PREPARATION:

A. Do not place deck panels on concrete supporting structure until concrete has cured and is dry.

B. Locate decking bundles to prevent overloading of supporting members.

3.3 INSTALLATION, GENERAL:

A. Install deck panels and accessories according to applicable specifications and commentary of SDI Publication No. 28, manufacturer's recommendations, and requirements of this Section.

B. Install temporary shoring before placing deck panels when required to meet deflection limitations.

C. Place deck panels on supporting framing and adjust to final position with ends accurately aligned and bearing on supporting framing before being permanently fastened. Do not stretch or contract side lap interlocks.

1. Do not place deck units on concrete supporting structure until concrete has cured and is dry.
2. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
3. Do not use deck units for storage or working platforms until permanently secured.
4. Place deck panels flat and square and fasten to supporting framing without warp or deflection.
5. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to the decking.
6. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.
7. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
8. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's instructions.

D. Deck Edge Tolerances: Perimeter deck edges shall be within =/- 1/2 inch of the indicated lines.

3.4 ROOF DECK INSTALLATION:

A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter, but not less than 1-1/2 inches (38 mm) long, and as follows:

1. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
2. Weld Diameter:
   a. 5/8 inch (16 mm), nominal.
3. Weld Spacing: Space and locate welds as indicated.
4. Weld Washers: Install weld washers at each weld location.
5. Side Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding 36 inches (910 mm), using one of the following methods:
   a. Mechanically fasten with self-drilling No. 10- (4.8-mm-) diameter or larger carbon steel screws.

B. End Bearing: Install deck ends over supporting framing with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints:
   a. Lapped 2 inches (51 mm) minimum.

C. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 45 psf at eave overhang and 30 psf for other roof areas.

D. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.

E. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking, and weld flanges to top of deck. Space welds not more than 12 inches (305 mm) apart with at least one weld at each corner.

F. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's recommendations. Weld to substrate to provide a complete deck installation.

3.5 FIELD QUALITY CONTROL:

A. Testing Agency: A qualified independent testing agency employed and paid Owner will perform field quality-control testing.

1. Field welds will be subject to inspection.

B. Testing Agency will report test results promptly and in writing to Contractor and Architect.

C. Remove and replace work that does not comply with specified requirements.

D. Additional testing will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION:

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces with galvanized repair paint according to ASTM A 780 and the manufacturer's instructions.

END OF STEEL DECK

SECTION 05 4000
COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud exterior wall framing.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 04 2000 - Unit Masonry: Veneer masonry supported by wall stud metal framing.

C. Section 05 3100 - Steel Decking.

D. Section 06 1000 - Rough Carpentry: Wood blocking and miscellaneous framing.

E. Section 07 2100 - Thermal Insulation: Insulation within framing members.

F. Section 09 5100 - Acoustical Ceilings: Ceiling suspension system.

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

E. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).

F. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to metal framing systems, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.05 SYSTEM DESCRIPTION

A. Horizontal Deflection: Design to permit maximum deflection of l/600 of span.

B. Vertical Deflection: Design non-axial loadbearing framing to accommodate not less than 1/2 in (13 mm) vertical deflection.

C. Design wall system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.

D. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

E. Work described in this Section includes galvanized steel stud framing systems for use at any new exterior metal stud walls and framing, interior load-bearing walls, and other locations as indicated on drawings.

1. Studs and runner tracks at exterior walls and interior load-bearing walls (if any) shall be 6-inches depth x 1-5/8-inches width x gauge indicated on the Drawings, and spaced at sixteen inches (16") o.c., unless otherwise indicated, with continuous bridging channels

and/or stud tracks as bridging channels, as indicated, and framed structural headers at all openings.

2. Joists and rafters (if any) and their stringers (at ends over bearing locations), bridging, and web stiffeners shall be as indicated herein, unless indicated otherwise on the Drawings; joists shall be spaced sixteen (16) inches o.c., directly over bearing studs or immediately adjacent to studs where anchored to sides of stud walls, unless otherwise indicated or accepted in writing by Architect.
3. Typical stud and joist sections shall be C-shape, and at least 1-5/8-inches width.
4. Galvanized steel strap bracing shall be provided, continuous at top and bottom runner tracks and at bridging locations at all curved stud walls.
5. Structural channels, studs, and joists, and other framing shall be as indicated on the Structural Drawings.

1.06 SUBMITTALS

A. See Section for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.

C. Product Data: For lateral-force resisting systems, provide product data sheets on hold-down, showing compliance with requirements.

D. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
   1. Indicate stud and ceiling joist layout.
   2. Describe method for securing studs to tracks and for bolted or welded framing connections.

E. Manufacturer's Installation Instructions: For lateral-force resisting systems, indicate welding procedure specifications.

F. Shop drawings shall bear the current State seal and license number of the manufacturer's and/or fabricator's Design Engineer.

1.07 QUALITY ASSURANCE

A. Designer Qualifications: Design framing system under direct supervision of a professional structural engineer experienced in designing this work and licensed in the State in which the Project is located.

B. Calculate structural properties of framing members in accordance with requirements of AISI North American Specification for the Design of Cold-Formed Steel Structural Members.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

D. Design structural elements under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

1.08 MOCK-UP

A. Construct a representative wall sample, 6 feet wide by 10 feet high, which includes face brick, mortar and accessories, architectural masonry veneer, cast stone, metal-framed storefronts, with masonry back-up and metal stud and sheathing backup where applicable; with accompanying flashing, sealants, and waterproofing (air barrier). Also, eave condition, including soffit and gutter is included. This panel will be for the purpose of approving the wall system and its components.

B. Locate where directed.

C. Coordinate with work of other Sections.

D. Approved mock-up will become standard for appearance and workmanship.

E. Mock-up may not remain as part of the Work.

F. Protect mock-ups from the elements with weather-resistant membrane.

G. When directed, demolish and remove mock-ups from Project site.

1.09 PROJECT CONDITIONS

A. Verify that field measurements are as indicated on shop drawings.

B. Coordinate work of this section with the placement of components within the stud framing system as specified in Section 09 2116 - Gypsum Board Assemblies.

1.10 DELIVERY, STORAGE AND HANDLING

A. Protect metal framing units from rusting and damage. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off ground in a dry ventilated space or protect with breathable waterproof tarpaulins.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Structural Framing:
1. Bostwick Steel Framing Co.
2. Dale Industries Inc.
3. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
4. The Formetal Company, Inc.: email: formetal@bellsouth.net.
5. Harrison Manufacturing Co.
6. MBA Metal Framing: www.mbastuds.com.
7. Milcor Division, Inryco Inc.
8. Unimast Incorporated
9. U.S. Gypsum Co
10. Substitutions: See Section 01 6000 - Product Requirements. .

B. Connectors:

2.02 PERFORMANCE REQUIREMENTS

A. Design Requirements: Design cold-formed framing systems, components and connectors to withstand specified design loads in compliance with ICC (IBC), ASCE 7, AISI S100, and AISI S240.

2.03 STRUCTURAL FRAMING COMPONENTS

A. Wall Studs and Track Sections: AISI S240; c-shaped studs and u-shaped track sections in stud-matching nominal width and compatible height.

B. System Components: With each type of metal framing and headers required, provide manufacturer's standard steel runners (tracks), blocking, bridging, lintels, clip angles, shoes, reinforcements, fasteners, and accessories as recommended by manufacturer for applications indicated, as needed to provide a complete metal framing system.

C. Materials and Finishes:
1. For 16-gage and heavier units, fabricate metal framing components of structural quality steel sheet with a minimum yield point of 40,000 psi; ASTM A 446, A 570, or A 611.
2. For 18-gage and lighter units, fabricate metal framing components of commercial quality steel sheet with a minimum yield point of 33,000 psi; ASTM A 446, A 570, or A 611.
3. Provide galvanized finish to metal framing components complying with ASTM A 525 for minimum G60 coating.
a. Finish of installation accessories to match that of main framing components, unless otherwise indicated.

2.04 ACCESSORIES

A. Stud Wall Bridging: 1-1/2-inches x 16-gage Cold Rolled Channel, unless otherwise indicated, anchored to each stud with 16-gage clip angles, or welded connections (where allowed by

manufacturer), and 16-gage splice plates, with spacing at 4'-0" or 4'-6" o.c. vertically, through pre-punched slots in studs.

B. Solid Joist Bridging: 1-5/8-inches x same gauge and depth as joists, unless otherwise indicated, anchored to joists webs with 2-inch x 2-inch x 16-gauge clip angles, or welded (where allowed by manufacturer) with continuous rows spaced at mid-span minimum, or 5'-0" o.c. maximum at clear span where span exceeds 10'-0".

C. Strap Bracing: 1-1/2-inches x 20-gage galvanized steel, anchored at ends, splices, and each stud with typical framing screws. Placement at curved walls shall align with radius or curve indicated at each such location.

D. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.

E. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.05 FASTENERS

A. Anchorage Devices: Power actuated and Screws with sleeves.

B. Electrodes for Welding: Comply with AWS Code.

2.06 FABRICATION

A. General: Framing components may be prefabricated into assemblies before erection. Fabricate panels plumb, square, true to line, and braced against racking with joints welded. Perform lifting of prefabricated units to prevent damage or distortion.

B. Fabricate units in jig templates to hold members in proper alignment and position and to assure consistent component placement.

C. Fastenings: Attach similar components by welding. Attach dissimilar components by welding, bolting, or screw fasteners, as standard with manufacturer. Wire tying of framing components is not permitted.
   1. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

D. Fabrication Tolerances: Fabricate units to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8-inch in 10 feet, and as follows:
   1. Spacing: Space individual framing members no more than plus or minus 1/8-inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
   2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8-inch (3 mm).

E. Headers: Form from at least two equal size C-shapes in a back-to-back or box type configuration.

2.07 SHOP FABRICATED ASSEMBLIES

A. Shop fabricate metal framing to the greatest extent possible.

B. Fabricate assemblies of framed sections of sizes and profiles required; with framing members fitted, reinforced, and braced to suit design requirements.

C. Fit and assemble in largest practical sections for delivery to site, ready for installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION - GENERAL

A. Manufacturer's Instructions: Install metal framing system in accordance with manufacturer's current printed or written instructions and recommendations, unless otherwise indicated.

B. Runner Tracks:
   1. Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks at all walls anchored to concrete floor and roof structure with threaded studs in expansion shields spaced 18-inches o.c., unless otherwise indicated.
   2. Track shall be spliced with channel insert fastened with two (2) sheet metal screws, bolts or rivets at each side, each flange, each corner. Provide fasteners at corners and ends of tracks.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

D. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners and bridging to supporting structure.

E. Install supplemental framing, blocking and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.

F. Erection Tolerances: Bolt or weld panels (at both horizontal and vertical junctures) to produce flush, even, true to line joints.
   1. Step in face and jog in alignment between panels not to exceed 1/16-inch.

3.03 INSTALLATION OF STUDS

A. Install wall studs plumb and level.

B. Frame wall openings larger than 2'-0" square with double stud at each jamb of frame except where more than two (2) are either shown or indicated in manufacturer's written instructions. Install cripple studs below and king studs and jack studs on each side/end of headers, minimum same size and gauge as wall studs where occurs, and anchor together securely. Install runner tracks and jack studs above and below headers at wall openings. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of wall. Secure stud system wall opening frame in manner indicated. Attach structural sheathing to each component.

C. Install horizontal bridging in all walls, and the additional strap bracing at curved walls as steel framing progresses. Install at spacing indicated and in compliance with stud manufacturer's written recommendations.

D. Frame both sides of expansion and control joints, with separate studs; do not bridge the joint with components of stud system

E. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

F. Install load-bearing studs full length in one piece. Splicing of studs is not permitted.

G. Install load-bearing studs; brace, and reinforce to develop full strength and achieve design requirements.

H. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

I. Install intermediate studs above and below openings to align with wall stud spacing.

J. Provide deflection allowance in stud track, directly below horizontal building framing at non-loadbearing framing.

K. Attach cross studs to studs for attachment of fixtures anchored to walls.

L. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

M. Touch-up field welds and damaged corrosion protected surfaces with primer.

3.04 FIELD QUALITY CONTROL

A. Testing (if required): All field quality-control testing shall be performed by a qualified independent testing agency. Refer to Section 01 0150 - “Special Conditions” for additional information and requirements.
   1. Field and shop welds will be subject to inspection and testing.
   2. Testing agency will report test results promptly and in writing to Contractor and Architect.
   3. Remove and replace Work that does not comply with specified requirements.
   4. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

3.05 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

3.06 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch (____ mm).

B. Maximum Variation of any Member from Plane: 1/16 inch (____ mm).

END OF SECTION

SECTION 05 4500

LIGHT GAUGE STEEL TRUSSES

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:

1. Gable-shaped trusses.
2. Cold-formed steel framing accessories.
3. Anchorage, bracing and bridging.

B. Definitions:

1. Pre-engineered light gauge steel trusses include planar structural units consisting of welded, screwed or bolted connected members which are fabricated, cut and assembled prior to delivery to the job site.

C. Miscellaneous Metal Fabrications including embed plates shown on the drawings are specified elsewhere in Division 5.

D. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work specified in this section.

E. Related Sections:
1. Section 05 3100 – Steel Deck
2. Section 05 4000 – Cold-formed Metal Framing

F. Design Requirements:
1. Design system components in accordance with AISI references.
2. Conform to the requirements of the Standard Building Code.
3. Maximum allowable deflections:
   a. $1/240^{th}$ of span under total loads
   b. $1/360^{th}$ of span under live loads.

1.2 SUBMITTALS:

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

1. Submit all shop drawings on one reproducible print (sepia) and one blue line print only.
2. The reproducible print will be returned. All blue line prints required by the Contractor are the responsibility of the Contractor and shall be made after reproducible is returned.

B. Product Data: Submit fabricator's technical data covering materials, shapes, hardware, fabrication process, handling and erection.

C. Shop Drawings: Submit shop drawings showing shapes and dimensions of members to be used including pitch, span, camber configuration and spacing for each type or configuration of truss required. Show all bearing and anchorage details. Specify and detail all supplemental strapping, bracing clips and other accessories required for proper installations, including temporary bracing and permanent member bracing. Shop drawings shall include all placement sequences and instructions.

1. Submit design analysis and test reports indicating loading, section properties, allowable stress, stress diagrams and calculations, and similar information needed for analysis and to insure trusses comply with requirements.
2. All designs shall bear the name and seal of a Structural Engineer licensed to practice in the State of Alabama Shop drawings which do not contain this information will be returned unchecked.

D. Quality Control Programs:

1. Submit written and bound quality control program that includes procedures for product certification and truss engineering, fabrication, handling, delivery, temporary storage, and erection procedures.
2. Quality Control Manual will be used as basis for inspection by a testing agency engaged by the Owner to determine compliance with the Quality Control Manual and other tests and observations noted herein.

E. Architect's Shop Drawing Review:

1. Review of shop drawings will be for general considerations only. Compliance with requirements for materials, fabrication, and erection of structural steel is the Contractor's responsibility.
2. Submit all shop drawings on one reproducible copy and two blueline prints only. Only the reproducible will be returned. Additional bluelines required by the Contractor are the Contractor's responsibility and shall be made after reproducible is returned. If additional bluelines are submitted, they will be returned unmarked.

1.3 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of the following except as otherwise indicated.

1. AISI "Specification for the Design of Cold-Formed Steel Structural Members," dated August 19, 1986 with December 11, 1989 addendum and design guide for cold formed steel trusses, Publication RG=9518.
2. ASTM A370 "Standard Test Methods and Definitions for Mechanical Testing of Steel Products."
3. ASTM A446 "Specifications for Sheet Steel, Zinc Coated (Galvanized) by the Hot-Dip Process, Physical (Structural) Quality"
4. ASTM A500 "Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural tubing in Rounds and Shapes."
5. ASTM A653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) of Zinc Alloy Coated by the Hot-Dip Process."

6. ASTM A780-93a "Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings."
7. AWS D1.1 "Structural Welding Code for Steel
8. AWS D1.3 "Structural Welding Code for Sheet Steel."

B. Qualifications For Welding Work: Quality welding processes and welding operations in accordance with AWS D1.3 "Structural Welding Code for Sheet Steel."

1. Provide certification that welders to be employed in the work have satisfactorily passed AWS qualification tests within the previous 12 months.
2. If recertification of welders is required, retesting will be the Contractor's responsibility.

C. Design Of Members And Connections: All details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at the site without causing delay in the work.

1. Promptly notify the Architect whenever design of members and connections for any portion of the structure are not clearly indicated.

D. Trusses shall be designed, fabricated, and erected by a firm which has a record including a minimum of five years of successfully designing, fabricating, and erecting trusses assemblies similar to scope required and which practices a quality control program.

1. Engineer Qualifications: A professional engineer legally authorized to practice in the jurisdiction where the project is located and is experienced in the services of the kind indicated.

E. Fabricators who wish to qualify for approval under this Section of the specification shall submit evidence of compliance with this specification no later that ten (10) days prior to the bid date. Only those fabricators approved in writing by the Architect prior to the bid date will be accepted.

1.4 DELIVERY, STORAGE, AND HANDLING:

A. Deliver materials to the site at such intervals to insure uninterrupted progress of the work.

B. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

C. Do not store materials on structure in a manner that might cause distortion or damage to supporting structures.

D. Deliver and handle products in exact accordance with the manufacturer's latest published requirements and specifications to avoid damage from bending, overturning, or other cause for which truss is not designed to resist or endure.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Sheet Steel: ASTM A446 "specification for Sheet Steel, Zinc Coated Galvanized by the hot-Dip Process, Physical (Structural) Quality."

1. Grade A, Fy = 33ksi; 18 gage and lighter
2. Grade D, Fy = 50 ksi; gage and heavier
3. Galvanizing: G-60 Coating Class

B. Galvanizing: ASTM A653

C. Fasteners: ITW Buildex pan head screws and bolts or others submitted and approved by the Architect.

D. Electrodes for Welding: Comply with AWS Code

E. Paint: Zinc Chromate, Oil-alkyd; TT-P-57, Type I.

2.2 DESIGN:

A. All calculations and procedures pertaining to design, analysis, and computation of section properties shall be in accordance with the Specification for the Design of Cold-Formed Steel Structural Members of the American Iron and Steel Institute.

B. Design trusses for loads indicated on drawings plus concentrated loads hung from or supported on trusses. Refer to mechanical, electrical and plumbing drawings and specifications for loading information and location. Loading as required by other subcontractors, such as fire protection, shall be coordinated by the general contractor.

C. Holes in Members: Design for holes in members where shown for securing other work to trusses; however, deduct area of holes from the area of chord when calculating strength of member.

D. Design bridging and other temporary and permanent bracing for same loads as used to design trusses plus any temporary loads and permanent loads resulting laterally bracing of members.

2.3 FABRICATION:

A. Light gage steel trusses may be fabricated either on the jobsite or at fabricator's shop.

B. All trusses shall be fabricated and erected in strict accordance with the current printed instructions of the approved subcontractor or fabricator.

C. All truss components shall be straight and true prior to fabrication. Flattening or straightening of components, when necessary, shall be accomplished in a manner so as to not damage the component.

D. All truss components shall be cut neatly to fit snugly against adjacent members.

E. No splices will be allowed in trusses except as authorized in writing by the Architect or as shown on the approved shop drawings.

F. Framing components shall be field or shop fabricated and joined to one another by means of welding or through the use of screws.

G. Completed trusses shall be free from twists, bends, or open joints with all members straight and true to line.

H. Welds must be thoroughly cleaned and wire brushed and primed and painted with a high zinc content paint capable of providing an equal or greater degree of protection than the original G-60 galvanized coating.

2.4 BRIDGING:

A. Fabricate horizontal or diagonal type bridging for trusses as required to prevent buckling of members where sheathing applied to the truss members is not present or is not adequate to brace the truss member. Bridging shall transfer all forces to roof diaphragm.

2.5 END ANCHORAGE:

A. Fabricate end anchorage to secure trusses to adjacent construction.

B. Fabricate all clips, angles, henways and other miscellaneous pieces necessary to attach light gage steel trusses to the substructure or to attach other components within this section to one another.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Erector must examine areas, dimensions and conditions under which the trusses are to be installed, and notify Contractor and Architect in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Erector. Additionally, the following items shall be installed and inspected prior to roof truss installation.

3.2 CONDITIONS OF SURFACES:

A. Exterior and Interior Bearing Plates
   1. Properly positioned.
   2. Installed so as to allow complete and adequate contact with truss connection member.

B. Exterior and Interior Bearing Plates installed in proper elevations so as to permit the installation of the truss system without the use of shims or adjustability.

3.3 PREPARATION:

A. Structural Adequacy: Contractor shall prepare the structure to insure proper and adequate structural support for the materials specified.

3.4 ERECTION:

A. Prefabricated trusses shall be braced against racking. Lifting of trusses shall be done so as to not cause local distortion in any member.

B. All light gage steel framing shall be erected using equipment of adequate capacity to safely perform the work.

C. The Contractor is responsible for checking the dimensions and assuring the fit of all members and trusses before erection begins.

D. All work shall be erected plumb and level and to dimensions and spacings indicated on the drawings. Provide bridging as shown in the shop drawings.

E. Assemblies shall be of the size and spacing shown on the approved shop drawings.

F. Provide web stiffeners and reinforcement at reaction points where required by analysis or to suit details.

G. Hoist units in place by means of lifting equipment suited to sizes and types of trusses required, applied at designated lift points as recommended by fabricator, exercising care not to damage truss members.

H. Provide temporary bracing as required to maintain trusses plumb, parallel and in location indicated, until permanent bracing is installed.

I. Anchor trusses securely at all bearing points to comply with methods and details indicated.

J. Install permanent bracing and related components to enable trusses to maintain design spacing, withstand design loads, and comply with other indicated requirements.

K. Do not cut or remove truss members.

3.5 TEMPORARY PLANKING:

A. Provide temporary planking and working platforms as necessary to effectively complete work.

3.6 FIELD ASSEMBLY:

A. Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening.

3.7 QUALITY CONTROL:

A. The Owner will engage an independent testing agency to perform shop and field inspection of trusses during fabrication.

B. Testing Agency shall conduct and interpret tests and state in each report whether observations and tests comply with the requirements and specifically state any deviations therefrom.

C. Provide Access for testing agency to places where truss work is being fabricated or produced so that required inspections, observations and testing can be accomplished.

D. Architect reserves the right, at any time before final acceptance, to reject material not complying with specified requirements regardless of when testing agency completed inspection, observation or testing.

E. Correct deficiencies in truss work which inspections and test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of correct work.

END OF LIGHT GAUGE STEEL TRUSSES

SECTION 05 5000
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items.

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.

B. Section 09 9100 - Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008 (Reaffirmed 2018).

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

G. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2025a.

H. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).

J. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

K. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

L. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 DESCRIPTION OF WORK

A. Work described in this section includes metal fabrications, which include items made from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems specified elsewhere. Types of work in this section includes metal fabrications for:

1. Rough hardware.
2. Loose bearing and leveling plates.
3. Loose steel lintels.
4. Miscellaneous framing and supports.
5. Ladder to attic hatch.
6. Guard posts (bollards), with concrete fill and matching metal domed cap welded on post.
7. Anchor plates, channels and/or angles with anchor bolts, as required for installation of prefabricated concrete bank vault assembly; galvanized.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Samples: Submit representative samples of materials and finished products as may be requested by Architect.

1.06 QUALITY ASSURANCE

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.07 PROJECT CONDITIONS

A. Field Measurements: Where fabrications are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabrication without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting acceptable to fabricator's professional engineer, and in a manner that will not affect structural performance, deflection, safety, etc.

1.08 COORDINATION

A. Coordinate installation of anchorages for metal fabrications and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation, without delaying the work of this section or the Work of the project.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.

F. Structural Steel Sheet: Hot-rolled, ASTM A 570; or cold-rolled ASTM A 611, Class 1; of grade required for design loading.

G. Galvanized Structural Sheet Steel: ASTM A 446, of grade required for design loading. Coating designation as indicated, or if not indicated, G90.

H. Steel Pipe: ASTM A 53; Type and grade (If applicable) as selected by fabricator and as required for design loading; black finish unless galvanizing is indicated; standard weight (schedule 40), unless otherwise indicated.

I. Gray Iron Castings: ASTM A 48, Class 30.

J. Malleable Iron Castings: ASTM A 47, grade as selected by fabricator.

K. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

L. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A 153

M. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

N. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

O. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ACCESSORIES

A. Grout: Non-Shrink Non-Metallic Grout: Pre-mixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with CE-CRD-C621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

B. Fasteners:
   1. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.

C. Paint:
   1. Metal Primer Paint: Southern Coating "Heavy Duty RIP Primer 1-0900", Tnemec "10-99 Primer", or approved equivalent.
   2. Primer selected must be compatible with finish coats of paint. Coordinate selection of metal primer with finish paint requirements specified in Section 09 9100 - Painting.
   3. Galvanizing Repair Paint: High zinc dust content paint for re-galvanizing welds in galvanized steel, complying with Military Specifications MIL-P-21035 (Ships), or SSPC-Paint-20.
   4. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.03 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
   1. Side Rails: 3/8 x 2 inches (9 x 50 mm) members spaced at 20 inches (500 mm).
   2. Rungs: one inch (25 mm) diameter solid round bar spaced 12 inches (300 mm) on center.
   3. Space rungs 7 inches (175 mm) from wall surface.

B. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; galvanized finish.

C. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.

D. Lintels: As detailed; galvanized finish.

E. Miscellaneous framing and supports:
   1. Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete work.

2. Fabricate miscellaneous units to sizes, shapes and profiles shown or, if not shown, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
3. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed. Except as otherwise shown, space anchors 24-inches o.c. and provide minimum anchor units of 1-1/4-inches wide x 1/4-inch x 8-inch long steel straps.
4. Galvanize exterior miscellaneous frames and supports

F. Rough hardware:
1. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in DIVISION 6 sections.
2. Fabricate items of sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2.05 FINISHES - STEEL

A. Prime paint steel items.
1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Surface Preparation:
1. Prepare ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specification and environmental exposure conditions of installed metal fabrications:
2. Exterior (SSPC Zone 1B): SSPC-SP6 "Commercial Blast Cleaning."
3. Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning."

E. Prime Painting: One coat.

F. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.

G. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

H. ASTM A 386 for galvanizing assembled steel products.

2.06 FABRICATION GENERAL

A. Workmanship:
1. Use materials of size and thickness shown or, if not shown, of required size and thickness to produce strength and durability in finished product. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.
2. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32-inch unless otherwise shown. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
3. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

4. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown, or if not shown, Phillips flat-head (countersunk) screws or bolts.
5. Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
6. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.
7. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

2.07 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).

D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).

E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

C. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

D. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete insets, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

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SECTION 06 1000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rough opening framing for doors, windows, and roof openings.
B. Sheathing.
C. Roof sheathing.
D. Roof-mounted curbs.
E. Roofing nailers.
F. Roofing cant strips.
G. Preservative treated wood materials.
H. Fire retardant treated wood materials.
I. Miscellaneous framing and sheathing.
J. Communications and electrical room mounting boards.
K. Concealed wood blocking, nailers, and supports.
L. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

A. Section 05 4500 - Light Gauge Steel Trusses: Prefabricated trusses for support of wood framing.
B. Section 05 5000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
C. Section 07 3113 - Asphalt Shingles: Shingles over sheathing.
D. Section 07 6200 - Sheet Metal Flashing and Trim: Sill flashings.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
B. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2024).
C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.
D. AWPA U1 - Use Category System: User Specification for Treated Wood; 2025.
E. PS 1 - Structural Plywood; 2023.
F. PS 20 - American Softwood Lumber Standard; 2025.
G. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber; 2019.
H. SPIB (GR) - Standard Grading Rules; 2021.
I. WCLIB (GR) - WCLB Standard Grading Rules for West Coast & Imported Softwood Lumber No.18; 2024.
J. WWPA G-5 - Western Lumber Grading Rules; 2025.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide technical data on wood preservative materials and application instructions.

C. Samples: For rough carpentry members exposed to view, submit two samples, ____ by ____ inch (____ by ____ mm) in size illustrating wood grain, color, and general appearance.

D. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

E. Submit proposed screw pattern layout for roof sheathing attachment, such that designed roof system meets I-90 Wind Uplift Requirements.

F. Submit data sheets and samples of all fasteners.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Southern Pine, unless otherwise indicated.
   2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
   3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. Northeastern Lumber Manufacturer's Association (NeLMA).
   2. National Lumber Grades Authority (NLGA).
   3. Redwood Inspection Service (RIS).
   4. Southern Pine Inspection Bureau (SPIB).
   5. West Coast Lumber Inspection Bureau (WCLIB).
   6. Western Wood Products Association (WWPA).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Roof Sleepers (1 by 4 inches).
   1. Species: Spruce-pine-fir (south) or Spruce-pine-fir.
   2. Grade: Construction or No. 2.
   3. Extent: Roof "Sleepers", and elsewhere as required or indicated.

E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 EXPOSED BOARDS

A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.

B. Moisture Content: Kiln-dry (15 percent maximum).

C. Surfacing: S4S.

D. Species: Southern Pine.

E. Grade: No. 2, 2 Common, or Construction.

2.04 CONSTRUCTION PANELS

A. Roof Sheathing: APA RATED SHEATHING, Veneer Core Plywood; Tongue and Groove Edges, and as follows:
   1. Exposure Durability Classification: Exterior.
   2. Span Rating: As required to suit rafter spacing indicated.
      a. 42/20 minimum, unless otherwise indicated.
   3. Thickness: 3/4-inch.

B. Communications and Electrical Room Mounting Boards: UL verified fire retardant backboard; A-C plywood; 3/4 inch (19 mm) thick; Coated with UL Classified Fire Retardant Latex (Class "A" Rated). Tested to UL723 (ASTM E84) standards. Color: As selected by Architect from manufacturer's standard colors.
   1. Manufacturers/Products:
      a. WoodBacker "Fire Retardant Backboards"; [Basis of Design]: www.woodbacker.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

C. Other Applications:
   1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
   2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
   3. Other Locations: PS 1, C-D Plugged or better.

2.05 ACCESSORIES

A. Metal and Finish of Fasteners:
   1. Untreated Wood: Unfinished steel.

B. Fasteners and Anchors:
   1. Metal and Finish: AISI Type 304 or 316 stainless steel for fire-retardant wood and preservative-treated wood locations; hot-dipped galvanized steel per ASTM A153/A153M for rough carpentry exposed to weather, in ground contact, or area of high relative humidity; unfinished steel elsewhere. Acceptable to manufacturer of wood treatment materials and manufacturers of fasteners.
   2. Anchors: Toggle bolt type for anchorage to hollow masonry.

C. Metal Framing Anchors:
   1. General: Provide metal framing anchors of type, size, metal, and finish indicated that comply with requirements specified including the following:
      a. Current Evaluation/Research Reports: Provide products for which model code evaluation/research reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with the building code in effect for this Project.
      b. Allowable Design Loads: Provide products for which manufacturer publishes allowable design loads that are determined from empirical data or by rational engineering analysis and that are demonstrated by comprehensive testing performed by a qualified independent testing laboratory.
   2. Galvanized Steel Sheet: Steel sheet zinc-coated by hot-dip process on continuous lines prior to fabrication to comply with ASTM A 525 for Coating Designation G90 and with ASTM A 446, Grade A (structural quality); ASTM A 526 (commercial quality); or ASTM A 527 (lock-forming quality); as standard with manufacturer for type of anchor indicated.
      a. Use galvanized steel framing anchors for rough carpentry exposed to weather, in ground contact, or in area of high relative humidity, and all other locations, and at every point of bearing.
      b. Minimum Thickness: 18-gauge.

D. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.

1. For contact with preservative treated wood in exposed locations, provide minimum G185 (Z550) galvanizing complying with ASTM A653/A653M.

E. Nails, Wire, and Brads: FS FF-N-105.

F. Power Driven Fasteners (screws): National Evaluation Report NER-272.

G. Wood Screws: ANSI B18.6.1.

H. Lag Bolts: ANSI B18.2.1.

I. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and where indicated, flat washers.

2.06 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifyiing level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
   1. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum fllame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Do not use treated wood in direct contact with the ground.
   2. Interior Type: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Interior rough carpentry items are to be fire retardant treated.
      c. All concealed wood blocking, framing and sheathing in buildings of Type I or Type II construction shall be fire retardant treated.
      d. Review Life Safety Sheets and provide fire retardant treated wood blocking in all rated walls.
      e. Do not use treated wood in applications exposed to weather or where the wood may become wet.

2.07 ENGINEERED WOOD PRODUCTS

A. General: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that evidence compliance with building code in effect for Project.
   1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide nonstructural framing and blocking to support the following:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Chalkboards and marker boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.
   10. Other wall- or ceiling-mounted items indicated on drawings.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at each roof opening except where prefabricated curbs are specified and where specifically indicated otherwise; form corners by alternating lapping side members.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
   1. Screw panels to framing; staples are not permitted.

B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.

2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.
4. Size and Location: As indicated on drawings.

3.06 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) from true position, maximum.

B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.07 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 5000.
1. Comply with applicable regulations.
2. Do not burn scrap on project site.
3. Do not burn scraps that have been pressure treated.
4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 2000
FINISH CARPENTRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Shop finishing.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 06 1000 - Rough Carpentry.

C. Section 06 4000 - Architectural Woodwork: Wood frames, countertops, etc.

D. Section 08 1416 - Flush Wood Doors.

E. Section 09 9100 - Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

C. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2024.

D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide instructions for attachment hardware.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.

D. Samples: Submit one sample of lumber or finish plywood, 12 by 12 inch (____by____ mm) in size, and two samples 3 by 3 inch in size, illustrating wood grain and specified finish.

E. Samples: Submit two samples of wood trim 6 inch (____ mm) long.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with AWI Architectural Woodwork Quality Standards Illustrated, Premium grade.

B. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire retardant requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect from moisture damage.

1.08 PROJECT CONDITIONS

A. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

B. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

PART 2 - PRODUCTS

2.01 MATERIALS - GENERAL

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Quality Standards Illustrated for Premium Grade.

2.02 SUSTAINABILITY CHARACTERISTICS

2.03 LUMBER MATERIALS

A. Softwood Lumber: SYP species, maximum moisture content of 6 percentof quality suitable for transparent finish.

B. Hardwood Lumber: white or yellow poplar species (coordinate with other wood trim), maximum moisture content of 6 percent.

2.04 SHEET MATERIALS

A. Softwood Plywood: PS 1 Grade A-B; Veneer core; SYP face species, (or similar species permitted by reference standards).

B. Hardwood Plywood: HPVA HP-1, Grade AA, Type I at exterior, Type II at Interior; Veneer core, type of glue recommended for application; Natural Birch face species, Rotary cut.

2.05 PLASTIC LAMINATE MATERIALS

A. Plastic Laminate: NEMA LD 3, HGS; color as selected; finish as selected.

2.06 ADHESIVE

A. Laminate Adhesive: Type recommended by laminate manufacturer to suit application; not containing formaldehyde or other volatile organic compounds.

2.07 FASTENINGS

A. Fasteners: Of size and type to suit application; galvanized finish in concealed locations and stainless steel finish in exposed locations.

B. Concealed Joint Fasteners: Threaded steel.

2.08 ACCESSORIES

A. Lumber for Shimming, Blocking: Softwood lumber of SYP species.

B. Primer: Alkyd primer sealer.

C. Wood Filler: Solvent base, tinted to match surface finish color.

2.09 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Cap exposed plastic laminate finish edges with material of same finish and pattern.

C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

D. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)

2.10 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

1. Transparent:
   a. System - 1, Lacquer, Nitrocellulose.
   b. Stain: As selected by Architect.
   c. Sheen: Flat.
2. Opaque:
   a. System - 1, Lacquer, Nitrocellulose.
   b. Color: As selected by Architect.
   c. Sheen: Flat.

E. Prime paint surfaces in contact with cementitious materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify wall surface is free of bows, humps, and other deficiencies that will be emphasized by the trim work. Report these issues to the Prime Contractor.

3.02 INSTALLATION

A. Set and secure materials and components in place, plumb and level.

B. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.

C. Install interior trim with wall adhesive by gun application. Install exterior trim and components with hot-dipped galvanized or stainless steel nails at 12" o.c., unless recommended otherwise by manufacturer.

D. Match grains and color so that individual pieces do not stand out.

3.03 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 09 9100 - Painting.

C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.04 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch (1.6 mm).

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

END OF SECTION

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SECTION 06 4000
ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Laminate clad countertops.

B. Laminate covered cabinets.

C. Wood cabinets, desks, and paneling.

D. Solid surface countertops, backsplashes and trim, where indicated; and vertical panels, where indicated.

E. Manufactured quartz solid surface countertop, backsplashes and trim, where indicated; and vertical panels, where indicated.

F. Closet and utility shelving (paint on site, under Section 09 9100).

G. Wood frames, sidelights, panels, base, window sills, and miscellaneous trim (paint on site, under Section 09 9100), stained (transparent finish) or painted (opaque finish) where indicated.

H. Hardware for architectural woodwork.

I. Related work and trim for above items.

J. Extent of each type of architectural woodwork is indicated on drawings and in schedules.

K. Architectural woodwork and components for opaque finish are intended to be finish painted on-site, under Section 09 9100.

L. Architectural woodwork and components for natural, stained and/or transparent finish are intended to be painted in woodwork fabricator's shop under controlled conditions, under the work of this Section.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Related work specified elsewhere includes:
   1. Section 06 1000 - Rough Carpentry.
   2. Section 06 2000 - Finish Carpentry.
   3. Section 07 9005 - Joint Sealers.
   4. Section 08 1416 - Flush Wood Doors.
   5. Section 09 9100 - Painting.
   6. Section 12 3219 - Laminate Casework.

1.03 SUBMITTALS:

A. Shop Drawings: Submit shop drawings showing location of each item, dimensioned plans and elevations, large scale details, attachment devices, blocking requirements and other components.
   1. Manufacturer's current and complete product data, for manufactured units of work, including color selection data, samples, and anchorage systems.

B. Samples: Submit the following samples:
   1. Lumber and panel products with or for transparent finish; 6-inches x 3/4-inch x 18-inches, for each species and cut, finished on 1-side and 1-edge. Also submit two 3 by 3 inch samples with finish on 1-side.
   2. Cabinet Hardware: One unit of each type and finish, which will be returned for use on the project, upon request by the Contractor.
   3. Quartz Solid Surface: Manufacturer's standard samples, approximately 6-inches x 6-inches with finish as required for this project, and representative color range anticipated.

4. Solid Surfacing and Plastic Laminate Products: Manufacturer's standard samples, approximately 4-inches x 6-inches, with finish as required for this project, and representative color range anticipated.

1.04 QUALITY ASSURANCE:

A. AWS: Comply with applicable requirements of "Architectural Woodwork Standards" published by the Architectural Woodwork Standards, 2nd Edition, October, 2014.

B. Fabricator Qualifications: Fabricators shall be experienced firms specializing in the types of architectural woodwork required for this project for at least 5-verifiable years and on at least 10-verifiable projects of similar size, scope, complexity, and quality as this project.
   1. Quartz Fabricator: 5-years and 10-verifiable projects.
   2. Solid Surfacing Fabricator: 5-years and 10-verifiable projects.

C. Installer Qualifications: Arrange for installation of architectural woodwork by the fabricator, or by a firm under the control and direction of the fabricator, which can demonstrate at least 5-verifiable years successful experience in installing architectural woodwork items on at least 5-verifiable projects, similar in type and quality to those required for this project.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Protect woodwork during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

B. Do not deliver woodwork, until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, woodwork must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

1.06 PROJECT CONDITIONS:

A. Conditioning: Woodwork Manufacturer and Installer shall advise Contractor of temperature and humidity requirements for woodwork installation and storage areas. Do not install woodwork until required temperature and relative humidity have been stabilized and will be maintained in installation areas.

B. Maintain temperature and humidity in installation area as required to maintain moisture content of installed woodwork within a 1.0-percent tolerance of optimum moisture content, from date of installation through remainder of construction period. Require Woodwork Manufacturer to establish optimum moisture content and required temperature and humidity conditions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Laminate Clad and Wood Cabinet Manufacturers: Subject to compliance with requirements, provide premium grade, custom made cabinets and woodwork from a millwork shop complying with requirements of "Quality Assurance" article above.

B. Plastic Laminate Manufacturer: See Finish Legend for Manufacturers and colors.

C. Solid-Surfacing Material/Manufacturer: Homogeneous solid sheets of cast, filled acrylic resin complying with material and performance requirements in ANSI Z124.3, for Type 6.
   1. See Finish Legend for Manufacturers and colors.

2.02 FABRICATION, GENERAL:

A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber at time of fabrication and for relative humidity conditions in the installation areas.

B. Fabricate woodwork to dimensions, profiles, and details indicated with dowel, dado, glue and screw construction, with openings and mortises precut, where possible, to receive hardware and other items and work.

1. Ease edges to a 1/16-inch radius, for corners of cabinets and edges of solid wood (lumber) members less than 1-inch in nominal thickness, 1/8-inch radius for edges of rails and similar members over 1-inch in nominal thickness.

C. Complete fabrication, assembly, hardware application, and other work before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Pre-Cut Openings: Fabricate architectural woodwork with pre-cut openings, where possible, to receive hardware, appliances, plumbing fixtures, electrical work and similar items. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape. Smooth edges of cutoffs and, where located in countertops and similar exposures seal edges of cutouts with a water-resistant coating.

E. Measurements: Before proceeding with fabrication of woodwork required to be fitted to other construction, obtain field measurements and verify dimensions and shop drawing details as required for accurate fit. A tight fit of less than 1/8-inch is expected.

F. Products in this Section shall be constructed only of materials that are formaldehyde-free.

2.03 FIRE-RETARDANT MATERIALS:

A. Where fire-retardant treated lumber is indicated, provide materials which are pressure impregnated with fire-retardant chemicals and comply with the following requirements:
   1. As required to comply with referenced standards and finish classifications necessary as per the Standard Building Code, NFPA 101 - Life Safety Code, authorities having jurisdiction, and acceptable in all respects for indoor use and finish requirements.
   2. Fire-Retardant Chemicals: Use chemicals of type and for applications indicated which do not bleed-through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated lumber from untreated lumber.

B. Fire Performance Characteristics: Provide materials which are identical to those tested per ASTM methods and time periods indicated, are marked and listed for fire performance characteristics by Underwriters Laboratories, Inc., or other testing and inspecting agency acceptable to authorities having jurisdiction, and comply with the following requirements:
   1. Mill lumber after treatment, within limits set for wood removal which does not affect listed fire performance characteristics, using a woodworking plant certified by testing and inspecting agency.

C. Marking: Identify treated lumber with separable paper classification marking of inspecting and testing agency, unless otherwise indicated.

D. Surface Burning Characteristics: Not exceeding values required by latest edition of the "Standard Building Code" and "NFPA 101" (with amendments), tested per ASTM E 84 for standard time period.
   1. Flame Spread: Per Code.
   2. Smoke Developed: Per Code.

E. Kiln-dry woodwork after treatment to levels required for non-fire-retardant treated woodwork materials. Maintain moisture content required by kiln drying, before and after treatment.
   1. Discard treated lumber which does not comply with requirements of referenced woodworking standard. Do not use twisted, warped, bowed, discolored, or otherwise damaged or defective lumber.

2.04 STANDING AND RUNNING TRIM:

A. Quality Standard: Comply with AWS Section 6 - Interior Millwork.

B. Rout or groove backs of flat trim members, kerf backs of other wide flat members, except for members with ends exposed in finished work.

C. Assemble Casings in plant except where limitations of access to place of installation require field assembly.

D. Interior Trim for Transparent Finish (typical finish unless specifically indicated otherwise): Comply with the following requirements:
   1. Grade: Premium, Grade I.
   2. Lumber Species: Match wood doors.
   3. Cut: Plain Sliced.
   4. Locations: Provide stained transparent finish within rooms which have new woodwork with transparent finish, at indicated areas. Refer to Elevations.

E. Interior Trim for Opaque Finish (only where specifically indicated, if any): Comply with the following requirements:
   1. Grade: Custom. Grade II.
   2. Lumber Species: Any closed-grain hardwood listed in referenced woodworking standard.
   3. Cut: Plain or Rotary cut.
   4. Locations: Provide opaque finish within rooms which have new woodwork with opaque finish, unless indicated otherwise. Refer to Elevations and Finish Legend.

2.05 ARCHITECTURAL COUNTER TOPS:

A. Quality Standard: Comply with AWS, Edition 1 - Section 11-Countertops.

B. Type of Top - Laminate Clad:
   1. Grade: Premium; Grade I.
   2. Edge Treatment: Refer to Drawings.
   3. Core: Minimum 47-lb. density particle board, except at least 3/4-inch A-B plywood with exterior glue (approved for interior use), at tops with sinks and/or plumbing fixtures.
   4. Minimum Thickness: 1-1/4-inches at tops and 3/4-inch at splashes, unless indicated otherwise on the Drawings.

C. Types of Top (and/or panel): Solid Surfacing.
   1. Colors, Patterns and Finishes: As indicated, or if not indicated, as selected from any of manufacturer's standard finishes and colors.
   2. Edge Treatment: As indicated on the Drawings.
   3. Thickness - Tops and Substrates:
      a. Tops (and any flat vertical panels): 3/4-inch, with 1-1/4-inch built-up edges unless indicated otherwise on the Drawings.
      b. Backsplash: 1/2-inch.
      c. Edge Treatment: As indicated on the Drawings, or if not indicated, ease all exposed edges to 1/16" radius, and seam width of less than 1/8".
         1) Manufacturer-approved adhesive to create color-matched seam.
      d. Substrates: Refer to the Drawings for thickness of plywood below solid surface tops, splashes, etc., or if not indicated, at least 3/4-inch thick at horizontal and sloped surfaces (and at least 1/2-inch thick at any vertical panels).
   4. Allowable tolerances:
      a. Flat and true to within 1/8" of a flat surface over a 10' length.
      b. Allow a minimum of 1/16" to a maximum of 1/8" clearance between surface and each wall.
      c. Variation in Component Size: 1/8" over a 10' length.
      d. Location of Openngs: 1/8" from indicated location.
   5. Provide manufacturer's 10-year warranty against defects in materials.
      a. Warranty shall provide material to repair or replace defective materials.
      b. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.
      c. The above warranty shall be in addition to, shall be in effect simultaneously with, and shall not limit or alter other project or product warranties or guarantees, nor shall it serve as limitation to other remedies available to the Owner.

2.06 FINISHING OF INTERIOR ARCHITECTURAL WOODWORK:

A. Quality Standard: Comply with AWS Section 5, unless otherwise indicated.

B. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing of concealed surfaces and similar preparations for finishing of architectural woodwork, as applicable to each unit of work.

C. Interiors for wood cabinets: To match wood veneer.

D. Melamine cladded interiors for wood cabinets: To match HPDL.

2.07 ARCHITECTURAL WOOD VENEER CABINETS:

A. Quality Standard:
   1. Comply with AWS Section 10.
   2. Grade: Premium.
   3. Design: Flush Overlay - Type A- Frameless construction.

B. Wood Veneer Cladding: As follows:
   1. Grade; Premium, Grade I.
   2. Lumber Species: Select White Birch, unless scheduled otherwise.
   3. Cut: Plain sliced.

C. Hardboard: AHA A135.4 (tempered).

D. Core Materials:
   1. MR Moisture Resistant Medium Density Fiberboard: Average 47-pound density grade, ANSI A208.2.
   2. Grade AB Plywood.

2.08 ARCHITECTURAL LAMINATE CLAD CABINETS:

A. Quality Standard:
   1. Comply with AWS Section 10.
   2. Grade: Premium.
   3. Design: Flush overlay - Type A- Frameless construction.

B. Laminate Cladding: High pressure decorative laminate complying with NEMA LD 3 and as follows:
   1. Colors, Patterns and Finishes: As indicated or, if not otherwise indicated, as selected by Architect from laminate manufacturers' standard products in the following categories: Solid, stippled, textured, wood grain and/or patterned colors; Thru-color type.
   2. Provide specific types as scheduled.
      a. Horizontal Surfaces: HGS, 0.048 inch (1.22 mm) nominal thickness, through color, colors as scheduled, finish as scheduled.
      b. Vertical Surfaces: VGS, 0.028 inch (0.71 mm) nominal thickness, through color, colors as scheduled, finish as scheduled.
      c. Post-Formed Horizontal Surfaces: HGP, 0.039 inch (1.0 mm) nominal thickness, through color, colors as scheduled, finish as scheduled.
      d. Post-Formed Vertical Surfaces: VGP, 0.028 inch (0.71 mm) nominal thickness, through color, colors as scheduled, finish as scheduled.
      e. Flame Retardant Surfaces: HGF, 0.048 inch (1.22 mm) nominal thickness, through color, colors as scheduled, finish as scheduled.
      f. Cabinet Liner: CLS, 0.020 inch (0.51 mm) nominal thickness, through color, colors as scheduled, finish as scheduled.
      g. Laminate Backer: BKL, 0.020 inch (0.51 mm) nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

C. Hardboard: AHA A135.4 (tempered).

D. Melamine cladded interiors in laminate cabinets.

E. Core Materials:
   1. MR Moisture Resistant Medium Density Fiberboard: Average 47-pound density grade, ANSI A208.2.

2.09 INTERIOR FRAMES AND JAMBS

A. Quality Standard: Comply with AWS Section 10.
   1. Grade: Premium.

B. Wood Species:
   1. For Opaque Finish: Any closed-grain hardwood listed in referenced woodworking standard.
   2. For Transparent Finish (stained): Match wood doors.

C. Fire Rated Frames:
   1. 20 min and 45 min rated types. Refer to Door Schedule.

D. Jamb Type: Flat jamb, unless indicated otherwise.

2.10 CLOSET AND UTILITY SHELVING:

A. Plastic laminate shelving where indicated.

B. Quality Standard: Comply with AWS Section 6.

C. Shelving for Opaque Finish: Comply with the following requirements:
   1. Grade: Custom.
   2. Shelving Material: Birch faced veneer core plywood.
   3. Exposed Edging: Solid hardwood.
   4. Thickness: 1-inch at wood shelves, unless indicated otherwise

D. Shelving for Transparent Finish: Comply with the following requirements:
   1. Location: Only in rooms where specifically indicated on Drawings.
   2. Grade: Custom.
   3. Species: AWS Veneer Grade A, Select Red Oak, or White or Yellow Poplar, Rotary Cut (unless scheduled otherwise).
   4. Thickness (plywood): 1-inch (minimum), with solid wood nosing.
   5. Lumber for shelving, only where indicated on the Drawings: 5/4-inch with nosings as indicated.

2.11 FASTENERS AND ANCHORS:

A. Screws: Select material, type, size and finish required for each use. Comply with FS FF-S-111 for applicable requirements.

B. Nails: Select material, type, size and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

C. Anchors: Select material, type, size and finish required by each substrate for secure anchorage. Provide non-ferrous metal or hot- dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion-resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

2.12 CABINET HARDWARE AND ACCESSORY MATERIALS:

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items which are specified in Section 08 7100 - Finish Hardware.

B. Hardware Standard: Comply with ANSI/BHMA A156.9 "American National Standard for Cabinet Hardware" for items indicated by reference to BHMA numbers or referenced to this standard.

C. Hardware Finishes: Comply with BHMA 1301 for finishes indicated by BHMA Code Numbers or if not otherwise indicated, provide finishes complying with requirements indicated.

1. For exposed hardware comply with requirements indicated for finish and base indicated at the end of this Section.
2. For concealed hardware provide manufacturer's standard finishes which comply with product class requirements of ANSI/BHMA A156.9, and which match exposed hardware on same cabinet unit.

2.13 SHELVING SUPPORTS AND RODS

A. Wall Mounted Brackets and Standards:
   1. Adjustable, double slotted, extra-heavy duty:
      a. Equivalent to K&V No. 85/185 Series Extra Duty Standards & Brackets.
         1) Standards: 1-1/4" wide x 1/2" deep x length indicated. 16 ga. steel. Finish & Color: TBS.
         2) Brackets: Vertically adjustable in 1" increments. 14 ga. & 16 ga. steel. Finish & Color: TBS.
   2. Clothes Rods:
      a. Closet Hanger Rod and Support:
         1) Rod: Equivalent to K&V No. 770-1. Extra-Duty. Steel. Chrome double-plated finish. Provide with end caps.
         2) Flanges: Equivalent to K&V No. 734 and No. 735, two (2) each per rod. Zinc cast. Finish: Match rod.
         3) Supports: Fixed closet rod and shelf brackets. Extra-Duty. Equivalent to K&V No. 1198. 10 ga. steel construction. Finish & Color: TBS.

B. Pilaster Standards and Supports: Provide adjustable shelf standards and related supports of type indicated, with matching finish on fasteners and accessories.
   1. Vertical Slotted Standard:
      a. Mortise mounted, 5/8-inch wide x 3/16-inch deep x length indicated; high strength steel.
      b. Equivalent to K&V No. 255, Finish & Color: TBS.
   2. Shelf Support:
      a. Shelf support clip; High strength steel.
      b. Equivalent to K&V No. 256, Finish & Color: TBS.

2.14 COUNTERTOP SUPPORT

A. Countertop support brackets, undercounter support frames, legs and miscellaneous metal parts shall be furniture steel, welded, degreased, cleaned, treated and epoxy powder painted. Color shall be as selected by Architect from manufacturer's standard colors.
   1. Support brackets shall be equal to Rakks EH Counter Support Bracket unless otherwise noted.
      a. For concealed support, provide Inside Wall Flush-Mount bracket.

2.15 CABINET HARDWARE

A. Cabinet Hinges: 170-degrees adjustable "CLIP System" concealed self-closing hinges as manufactured by Julius Blum, Inc., or equivalent by Grass or Stanley.
   1. Finish shall match hardware finish specified in Section 08 7100 - Finish Hardware in room(s) where occurs.

B. Cabinet Hinges: Equivalent to 5-knuckle exposed self-closing hinges as manufactured by Julius Blum, Inc., Grass or Stanley.
   1. Finish shall match hardware finish specified in Section 08 7100 - "Finish Hardware" in room(s) where occurs.

C. Cabinet Door and Drawer Pulls:
   1. Wire pulls, equivalent to Stanley No. 4484, (ANSI B12012), 4-inches long, with 1-inch clearance; unless indicated otherwise. Pull design shall comply with the Americans with Disability Act (ADA).
      a. Finish shall match hardware finish specified in Section 08 7100 - Finish Hardware.

D. Cabinet Door Catches: Manufacturer's standard 2-screw sill mounted unit made of molded nylon, lipped over sill to form bumper and hold in place, with 2-screw mounted heavy door mounted unit with nylon roller; provide spring-mounted units where required.
   1. Acceptable Manufacturers: Any of manufacturers listed for other cabinet hardware.

E. Cabinet Drawer Slides: Heavy Duty, non-corrosive (galvanized) full extension ball bearing slides rated at 100-pounds, with positive stop, and self-closing and lift-out disconnect features; Model No. 1429, as manufactured by Knape & Vogt, or equivalent by Blum or Grant.
   1. At legal size drawers, use K&V No. 1483 or equivalent, rated at 150-pounds, with same features as noted above.

F. Cabinet Shelf Standards: Manufacturer's standard steel units with anchors and supports 5/8-inch wide x 3/16-inch high, adjustable on 1/2-inch centers; Series 255, as manufactured by K&V, or equivalent by Grant or Stanley.
   1. Wood Cabinets: Model No. 255 BRN with No. 256 BRN supports and matching fasteners.
   2. Omit standards where fixed shelves are indicated.
   3. All standards to be recess mounted (flush in routed dados), unless specifically indicated otherwise.

G. Cabinet Locks: Where indicated on the Drawings, provide cabinet manufacturer's standard 5-disc tumbler, cam type, keyed differently at each room , with metal strike screwed to wood surface, and master keyed.
   1. Furnish 2-keys for each lock.
   2. Furnish 5-master keys
   3. Finish to match Section 08 7100 - Finish Hardware finish in room(s) where occurs.
   4. Location: Where indicated.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.

B. Pre-Installation Meeting: Meet at project site prior to delivery of architectural woodwork and review coordination and environmental controls required for proper installation and ambient conditioning in areas to receive work. Include in meeting the Contractor; Architect and other Owner Representatives (if any); Installers of architectural woodwork, wet work such as plastering, other finishes, painting, mechanical work and electrical work; and firms or persons responsible for continued operation (whether temporary or permanent) of HVAC system as required to maintain temperature and humidity conditions. Proceed with woodwork installation only when everyone concerned agrees that required ambient conditions can be maintained.

C. Deliver concrete inserts and similar anchoring devices to be built into substrates, well in advance of time substrates are to be built.
   1. Coordinate location and placement of concealed treated blocking (by others) prior to finish materials installations.

D. Prior to installation of architectural woodwork, examine shop fabricated work for completion, and complete work as required, including back priming and removal of packing.

3.02 INSTALLATION:

A. Quality Standard: Install woodwork to comply with AWS Section 2, 6, 10, 11 for the same grade specified in Part 2 of this Section for type of woodwork involved.

B. Install woodwork plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8-inch in 8'-0" for plumb and level (including tops); and with no variations in flushness of adjoining surfaces.

C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.
   1. Seal all hardware cuts, routed slots, etc., before installation of hardware.

D. Anchor woodwork to anchors or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fasteners heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork, and matching final finish where transparent finish is indicated.

E. Standing and Running Trim, and Sills: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns, miter at corners and comply with referenced Quality Standards for joinery.

F. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated. Maintain veneer sequence matching (if any) of cabinets with transparent finish.
   1. Install cabinets with no more than 1/8-inch in 96-inches sag, bow, or other variation from a straight line.

G. Wood Storage Shelving: Complete the assembly of units and install in the areas indicated, including hardware and accessories as indicated.

H. Tops: Anchor securely to base units and other support systems indicated. Caulk space between backsplash and wall with specified sealant.
   1. Install countertops with no more than 1/8-inch in 96-inches sag, bow, or other variation from a straight line.

I. Wood Panels: Anchor panels to supporting substrate with concealed panel-hanger clips and by blind nailing on backup strips, splined-connection strips, and similar associated trim and framing. Do not face nail unless otherwise indicated.
   1. Install flush panels with no more than 1/16-inch in 96-inches vertical cup or bow and 1/8-inch in 96-inches horizontal variation from a true plane.

J. Install shelf brackets according to manufacturer's written instructions, spaced not more than 32 inches o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

K. Install standards for adjustable shelf supports according to manufacturer's written instructions. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Space fasteners not more than 12 inches o.c.

L. Install standards for adjustable shelf brackets according to manufacturer's written instructions, spaced not more than 36 inches o.c. and within 6 inches of ends of shelves. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

M. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled. Install shelves, fully seated on brackets, and supports.
   1. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.

N. Install rod flanges for rods as indicated. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Install rods in rod flanges.

O. Refer to Section 09 9100 - Painting, for final finishing of installed architectural woodwork which is indicated to be painted on-site.

3.03 ADJUSTMENT, CLEANING, FINISHING, AND PROTECTION:

A. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch-up shop-applied finishes to restore damaged or soiled areas.

D. Complete the finishing work specified as work of this section, to whatever extent not completed at shop or prior to installation of woodwork.

E. Provide final protection and maintain conditions, in a manner acceptable to Fabricator and Installer, which ensures architectural woodwork being without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 07 1400
FLUID-APPLIED AIR BARRIER

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sealants for substrates of fluid-applied air barrier.

B. Other Accessories.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 04 2000 - Unit Masonry: Masonry joints prepared to receive flashings.

C. Section 07 1300 - Sheet Waterproofing: Sheet membrane waterproofing for below grade slab and walls.

D. Section 07 9005 - Joint Sealers: Sealant for joints other than substrates for air barrier in this Section.

E. Section 09 2116 - Gypsum Board Assemblies: Exterior sheathing receiving fluid-applied air barrier.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM C836/C836M - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course; 2018 (Reapproved 2022).

C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

D. ASTM E 2178 Standard Test Method for Air Permeance of Building Materials.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for air barrier system(s) specified.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures and acceptable installation temperatures.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Membrane Manufacturer Qualifications: Company specializing in fluid-applied air barrier membranes with ten years experience.

B. Installer Qualifications: Company specializing in installation of fluid-applied air barrier with minimum five years documented experience.

C. Mock-Up: Include Fluid-Applied Air Barrier in Mock-Up as described in Section 01 4000 - Quality Requirements.

D. Comply with ALL special requirements and inspections of air barrier system manufacturer, as required to obtain the required 5-year labor and materials warranty.

E. Single-Source Responsibility: Obtain primary air barrier materials of each type required from a single manufacturer.

F. Sealant for Substrate Surfaces: Sealant shall be manufactured by same manufacturer as fluid-applied air barrier.

1.06 FIELD CONDITIONS

A. Maintain range of ambient and substrate temperatures recommended by air barrier manufacturer. Do not apply product to wet substrate or during snow, rain, fog, or mist.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five (5) year manufacturer warranty for air barrier failing to resist penetration of water , except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Fluid-Applied Waterproofing Vapor Permeable Air Infiltration Barrier System (for CMU, Sheathing, and as indicated):
   1. GE "Elemax 2600 AWB" 100% Silicone Air and Water-Resistive Barrier system; [Basis of Design]: www.siliconeforbuilding.com/AWB/.
   2. Dow Corning "DefendAir 200" Silicone Liquid Applied Air & Weather Barrier: www.dowcorning.com.
   3. Pecora "XL-Perm Ultra VP" Air, Vapor & Water Barrier System: www.pecora.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FLUID-APPLIED WATERPROOFING MATERIALS

A. Fluid-Applied Air Barrier - General: Cold-applied elastomeric fluid-applied membrane.
   1. General: Provide fluid-applied air barrier system that is watertight and complies with performance requirements specified, as demonstrated by testing performed by a nationally recognized independent testing laboratory of manufacturer's standard systems according to test methods indicated.
   2. Fluid-applied air barrier system shall be compatible with specified substrate.

B. Liquid Air Infiltration Barrier, Vapor Permeable, Cold-Applied Elastomeric Membrane:, complying with ASTM C 836, one component. (For CMU, Sheathing, and as indicated).
   1. Cured Thickness: Comply with manufacturer's recommendation to meet performance specified.
   2. Suitable for installation over concrete, and sheathing substrates.
   3. UV Resistant.
   4. Membrane Air Permeance ASTM E2178: Not to exceed 0.004 cfm/sq. ft. of surface area (at specified thickness) at test pressure of 0.3 in. water (75 Pa) on CMU block.
   5. Membrane Vapor Transmission per ASTM E96, Method B: Not less than 10 perms.
   6. Product shall withstand weather exposure up to 6 months.

C. Flexible Flashings: Type recommended by membrane manufacturer.

2.03 ACCESSORIES

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Joint Reinforcing/Transition Strip: 2" wide glass fiber tape, self-adhesive polymeric air/vapor barrier membrane (30 mil minimum), or other material applicable for application, which is approved by air barrier manufacturer.

C. Surface Conditioner: Compatible with membrane compound; as recommended by membrane manufacturer.

D. Sealant for Substrate Surfaces: As recommended by membrane manufacturer.

E. Liquid Membrane for details and terminations: As recommended by membrane manufacturer.

F. Detail Membrane: Flexible, fully-adhered membrane for detail flashing areas: As recommended by membrane manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter, including efflorescence, detrimental to adhesion or application of air barrier system.

C. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of air barrier materials.

D. Verify that items that penetrate surfaces to receive air barrier are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive air barrier.

B. Do not apply air barrier to surfaces unacceptable to manufacturer.

C. Caulk sheathing joints prior to application of water/air barrier coating. Caulk with manufacturer-recommended joint sealant reinforced with fiberglass mesh tape encapsulated in sealant. Encapsulate fastener heads with manufacturer-recommended sealant. Fiberglass reinforcement is not required for sheathing fastener heads.
   1. Verify that Fluid-Applied air barrier is compatible with sealant used.

D. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

E. All surfaces must be sound and free from spalled areas, loose aggregate, loose nails or screws, sharp protrusions or other matter that will hinder the adhesion or regularity of the membrane installation. The surface must also be free from frost, dirt, grease, oil or other contaminants. Clean loose dust and dirt from the surface by brushing or wiping with a clean, dry cloth.

F. Concrete and other monolithic cementitious surfaces: Pretreat surface irregularities and large voids with liquid membrane, or repair with lean mortar mix or nonshrinking grout.

G. CMU surfaces: Strike joints full and flush to face of concrete block. Ensure surface is smooth and free from projections. Fill voids and holes with lean mortar mix or nonshrinking grout.

H. Sheathing panels: Fasten corners and edges with appropriate screws. Drive fasteners flush with panel surface (not countersunk). Tape panel butt joints with 2 in. wide sheathing tape recommended by manufacturer.

I. Complete detailing prior to applying air barrier.

J. Fill and seal cracks and joints between exterior sheathing panels or adjacent substrates, or in masonry, with trowel application of air barrier product and reinforce with strip of 2" (minimum) wide glass fiber tape. Follow manufacturer's instructions if other joint treatment is recommended. Allow recommended cure time before proceeding.

K. Proceed with applying air barrier only after substrate cleaning, sealing, and other preparation and sealing of joints and penetrations have been completed.

3.03 INSTALLATION

A. Apply air barrier in accordance with manufacturer's instructions .

B. Apply surface conditioner (if required) at a rate recommended by manufacturer. Protect conditioner from rain or frost until dry.

C. Apply by spray a complete and continuous unbroken film of liquid air and water barrier membrane.

D. Apply air barrier in accordance with manufacturer's instructions to uniform wet film thickness in order to dry to thickness recommended by manufacturer to achieve performance specified.
   1. Apply more than one coat, if recommended by manufacturer.

E. Roll the air barrier after spray application to fill all pin holes.

F. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

G. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Owner will provide testing services, and Contractor to provide temporary construction and materials for testing.

C. Provide daily on-site attendance of waterproofing and insulation manufacturer's representative during installation of this work.

3.05 CLEANING AND PROTECTION

A. Do not inhibit damp substrate from drying out. Do not expose the backside of the substrate to moisture or rain.

B. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

C. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 180 days.

D. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construcion.

E. Remove masking materials after installation.

SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at cavity wall construction.

B. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

C. Batt insulation above-ceiling construction, with vapor barrier, where indicated.

D. Batt insulation in walls where indicated.

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry Assemblies: Cavity walls for board insulation.

B. Section 07 2216 - Roof Board Insulation (Nail Base).

1.03 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

D. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2026.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.05 MOCK-UP

A. Include Thermal Insulation in mock-up as described in Section 01 4000 – Quality Requirements.

1.06 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation Inside Masonry Cavity Walls: Expanded polystyrene (EPS) board.

B. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.

C. Insulation Above Ceilings (where indicated): Batt insulation with no vapor retarder (i.e. unfaced batts) where used with sheet vapor barrier.

2.02 FOAM BOARD INSULATION MATERIALS

A. Expanded Polystyrene (EPS) Board Insulation: Comply with ASTM C578.
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.

B. Extruded Polystyrene (XPS) Board Insulation at masonry cavity walls: Complies with ASTM C578 with either natural skin or cut cell surfaces.
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.

3. Board Size: 48 x 96 inch (1220 x 2440 mm).
4. Board Thickness: 1 inch (25 mm), unless indicated otherwise.
5. Products:
   a. DiversiFoam Products: www.diversifoam.com.
   b. Dow Chemical Company: www.dowbuildingsolutions.com/#sle.
   c. Kingspan Insulation LLC; GreenGuard GG25-LG XPS Insulation Board: www.kingspan.com/#sle.
   d. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

C. Extruded Polystyrene (XPS) Cavity Wall Insulation Board: Comply with ASTM C578, and manufactured using carbon black technology.
1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
3. Type and Thermal Resistance, R-value (RSI-value): Type IV, 5.6 (0.98), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.
4. Board Size: 15-3/4 inch by 96 inch (400 mm by 2440 mm).
5. Board Thickness: 1-3/4 inch (44.5 mm).
6. Board Edges: Square.

2.03 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
4. Formaldehyde Content: Zero.
5. Thickness: As required to meet the following requirements:
   a. Roof: R=30.
   b. Exterior walls: R=19.
   c. Interior walls: Thickness of Studs.
6. Facing: Unfaced in interior walls, and where used above ceilings in conjunction with Class A sheet vapor barrier.
7. Products:
   a. CertainTeed Corporation: www.certainteed.com/#sle.
   b. Johns Manville: www.jm.com/#sle.
   c. Knauf Insulation: www.knaufinsulation.com.
   d. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

B. Mineral Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
1. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
2. Formaldehyde Content: Zero.
3. Thickness: As required to meet the following requirements:
   a. Roof: R=30.
   b. Exterior walls: R=19.
   c. Interior walls: Thickness of Studs.
4. Facing: Unfaced in interior walls, and where used above ceilings in conjunction with Class A sheet vapor barrier.
5. Products:
   a. Owens Corning: www.owenscorning.com.
   b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

A. Sheet Vapor Barrier: Foil facing comprised of 0.0003"aluminum foil bonded to 30 lb. kraft paper with flame retardant adhesive and reinforced with tri-directional fiberglass scrim, or woven polyethylene film sandwiched between two layers of metalized film. Sheet vapor barrier must meet Class A flame spread classification; with flame spread rating less than 25, and smoke developed rating less than 450, in accordance with ASTM E 84. For substitutions, see Section 01 6000 - Product Requirements.

B. Tape: Polyethylene self-adhering type, 1.75 inch wide minimum.
   1. 3M "Construction Seaming Tape 8087": www:3M.com.
   2. Dow "Weathermate Construction Tape": www.dowbuildingsolutions.com.
   3. Typar "Typar Construction Tape": www.typar.com.

C. Tape: Reinforced foil tape: Type recommended by sheet vapor barrier manufacturer.

D. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

3.02 BOARD INSTALLATION AT CAVITY WALLS

A. Adhere a 6 inches (152 mm) wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.
   1. Tape seal joints between sheets.
   2. Extend sheet full height of joint.

B. Apply adhesive to back of boards:
   1. Three continuous beads per board length.
   2. Apply beads of adhesive oriented vertically so as not to disrupt the drainage plane between the water/air barrier coating and cavity insulation.

C. Install boards to fit snugly between wall ties.

D. Install boards horizontally on walls.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and protrusions.
   4. Tape seal board joints.

E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

F. Place 6 inches (152 mm) wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames, and tape seal in place to ensure continuity of vapor retarder and air seal.

3.03 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

C. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

D. Retain insulation batts under overhead joists/rafters/trusses with sheet vapor barrier under framing members.

E. Install sheet vapor barrier under trusses with foil facing down. Overlap layers as recommended by manufacturer. Attach vapor barrier as recommended by manufacturer. Tape joints with reinforced foil tape recommended by manufacturer.

F. Lay insulation batts over top of sheet vapor barrier.

G. All wet insulation shall be removed and replaced. Provide letter to Architect for record of each occurrence.

H. Visible gaps and voids for insulation on sheet vapor barrier shall be filled.

3.04 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 2216
ROOF BOARD INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Ventilated Nail-Base Insulation Panel System.

1.02 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related work specified elsewhere includes:
   1. Section 05 3100 - "Steel Decking"
   2. Section 07 3113 - “Asphalt Shingles”

1.03 SUBMITTALS:

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of insulation product and accessory specified.

1.04 MOCK-UP

A. Include Roof Board Insulation in mock-up as described in Section 01 4000 - Quality Requirements.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer’s recommendations for handling, storage, and protection during installation.

PART 2 - PRODUCTS

2.01 VENTILATED NAILBASE INSULATION PANELS

A. Ventilated Nailbase Insulation Panel: Venting composite insulation board. Top layer - minimum 5/8-inch 5-ply CDX plywood; Middle layer - 1" wood spacers, or 1" EPS spacers, spaced as recommended by manufacturer. Bottom layer - polyisocyanurate foam insulation. Provide eave / perimeter nailer panels. Minimum LTTR value of R20.5.
   1. Manufacturer/Product:
      a. HunterPanels; "Cool-Vent": www.hunterpanels.com.
      b. Atlas Roofing Corp. "ACFOAM Crossvent Insulation": www.atlasroofing.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FASTENERS

A. Fasteners shall be approved by manufacturer for type of decking used. Fasteners shall be corrosion resistant. Fasteners shall have 3/16-inch shank (unless recommended otherwise by manufacturer), and have oversized heads. Length of fasteners shall be as recommended by panel manufacturer. Fasteners shall penetrate top flute of steel deck minimum of 1 inch. Do not penetrate bottom flute.

2.03 ACCESSORIES:

A. Panel Sheathing Clips: Provide panel sheathing clips in quantity and location recommended by manufacturer. For use at unsupported edges. Simpson Strong-Tie Panel Sheathing Clips PSCA, 20 gauge, galvanized. Substitutions: See Section 01 6000 - Product Requirements.

B. Other Accessories: Provide other installation accessories and materials necessary for proper installation, in compliance with manufacturer’s current written instructions and recommendations.

PART 3 - EXECUTION

3.01 EXAMINATION (NAILBASE INSULATION PANELS)

A. Do not begin installation until structural deck has been properly prepared.

B. Verify deck, adjacent materials, and structural backing is dry and ready to receive insulation.

C. Verify deck surface is flat, free of fins or protrusions and irregularities.

D. If deck preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION (NAILBASE INSULATION PANELS)

A. Install panels with the plywood side face up. Place panels in the manufacturers recommended pattern. Only factory assembled panels will be accepted. Fasten panels through the top nailable surface and also through the wood block panel spacers using manufacturer's approved threaded fasteners.

B. For roof slopes up to 7/12 pitch, 7 inches rise in 12 inches, the minimum number of fasteners shall be 20 per 4 foot by 8 foot panel.

C. For roof slopes over 7/12 pitch, 7 inches rise in 12 inches, the minimum number of fasteners shall be 25 per 4 foot by 8 foot panel.

D. Where unsupported edges of plywood occur, and where partial panels are used, such as at hip and valleys, add additional blocking for support along unsupported edge where needed.

3.03 PROTECTION (NAILBASE INSULATION PANELS)

A. Protect installed products until completion of project.

B. Cover the top and edges of unfinished roof panel work to protect it from the weather and to prevent accumulation of water in the cores of the panels.

C. Do not leave panels exposed to moisture. Wet panels shall be removed or allowed to completely dry prior to application of vapor barrier and/or roof covering.

D. Apply only enough insulation panels per day that can be covered the same day by a completed roof covering material.

END OF SECTION

SECTION 07 3113
ASPHALT SHINGLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible sheet membranes for eave protection, underlayment, and valley protection.

B. Flashing.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Roof sheathing.

B. Section 07 2216 - Roof Board Insulation (Ventilated Nail Base): Ventilated nail-base insulation panels.

C. Section 07 6200 - Sheet Metal Flashing and Trim: Edge and cap flashings.

D. Section 07 7123 - Manufactured Gutters and Downspouts.

1.03 REFERENCE STANDARDS

A. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2025.

B. ASTM D3161/D3161M - Standard Test Method for Wind Resistance of Steep Slope Roofing Products (Fan-Induced Method); 2020 (Reapproved 2025).

C. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement; 2025.

D. ASTM D4869/D4869M - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing; 2016a (Reapproved 2025).

E. ASTM F1667/F1667M - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples; 2021a.

F. NRCA (RM) - The NRCA Roofing Manual; 2025.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating material characteristics, performance criteria, and limitations.

C. Specimen Warranty:
   1. Provide an unexecuted copy of the warranty specified for this Project. Identify the terms and conditions required of the manufacturer along with any and all additionally required riders. Identify the terms and conditions required of the Owner to maintain the warranty.
      a. Submit a letter from the Roofing Contractor to be included in the warranty. This letter shall be signed and dated to indicate the Roofing Contractor has reviewed the roofing system and therefore warrants the system as designed and intended to be warrantied.
      b. Submit a letter from the roofing manufacturer to be included in the warranty. This letter shall be signed and dated by a manufacturer's representative to indicate the manufacturer has reviewed the roofing submittal from the Roofing Contractor and confirms compliance with specifications based on materials supplied in the submittal.

D. Shop Drawings: For shingles, indicate nail pattern layout and starter shingle product, such that designed roof system has wind speed coverage of 120 mph, or that shown on structural drawings.

E. Shop Drawings: For metal flashings, indicate specially configured metal flashings and installation details.

F. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, and setting plan for tapered insulation. Show penetration details, and indicate field-

wrapped flashing. Provide insulation fastening/adhesion patterns for any and all pieces of insulation required for roof system.

G. Samples: Submit two samples of each shingle color indicating color range and finish texture/pattern ; for color selection.

H. Samples: Submit two samples of ridge vent material and each roofing accessory.

I. Samples: Submit data sheets and samples of all fasteners.

J. Manufacturer's Installation Instructions: Indicate installation criteria and procedures.

K. Copies of all roofing submittals and roof warranty information shall be submitted for review and returned Approved prior to pre-roofing conference. These submittals shall be job specific containing project name, location, etc.

L. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer, and are installed in accordance with manufacturer's recommendations, as called for under Field Quality Control article in this Section.

M. Roofing and insulation manufacturers shall submit a letter stating they will provide site inspections that confirm the project is being constructed as specified, by an experienced, full-time employee of the respective manufacturer. This letter shall be submitted with sample warranty submittal.

N. Provide Manufacturer's documentation certifying that the roof design provided complies with the performance requirements for that particular system, as set forth in IBC Chapter 15 in Section 1504. The documentation shall be attached to the roof warranty provided at the close-out of the project.

O. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements for additional provisions.
   2. Extra Shingles: 5% of each type and color.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an Installer (Roofer) to perform roofing work who has not less than five (5) years successful experience in installing roofing systems similar to that required for this Project and who is acceptable to or licensed by the manufacturer of primary roofing materials.
   1. Installer's Field Supervision: Require Installer to maintain a full-time supervisor/foreman who is on job-site during times that roofing work is in progress and who is experienced in installing roofing systems similar to type and scope required for this Project.

B. Manufacturer Qualifications: The manufacturer shall have a minimum of 5 years experience in the manufacture of the roofing system and must also be the original material manufacturer of the primary roofing materials. Provide secondary products as recommended by manufacturer of primary products to use with roofing system specified.

C. Insurance and Code Requirements: Provide materials complying with governing regulations that can be installed to comply with the following:
   1. UL Fire Classified.
   2. Wind Speed Resistance: 120 mph.

D. Insurance Certification: Assist Owner in preparing and submitting roof installation acceptance certification as necessary in connection with fire and extended-coverage insurance on roofing and associated work.

E. UL Listing: Provide roofing system and component materials that have been tested for application and slopes indicated and that are listed by UL for Class A external fire exposure.
   1. Provide roof-covering materials bearing UL Classification Marking on bundle, package, or container indicating that materials have been produced under UL's Classification and Follow-up Service. Submit nailing pattern and size of plates.

F. PRE-ROOFING CONFERENCE:
   1. A pre-roofing conference is required before any roofing materials are installed. This conference shall be conducted by a representative of the Architect and attended by representatives of the Owner, General Contractor, Roofing Contractor, Sheet Metal Contractor, Roof Deck Manufacturer (if applicable) and the Roofing Materials Manufacturer (if warranty is required of this manufacturer). If equipment of substantial size is to be placed on the roof, the Mechanical Contractor must also attend this meeting.
   2. The pre-roofing conference is intended to clarify demolition (for renovation or re-roofing projects) and application requirements for work to be completed before roofing operations can begin. This would include a detailed review of the specifications, roof plans, roof deck information, flashing details and approved shop drawings, submittal data, and samples. If conflict exists between the specifications and the Manufacturer's requirements, this shall be resolved. If this pre-roofing conference cannot be satisfactorily concluded without further inspection and investigation by any of the parties present, it shall be reconvened at the earliest possible time to avoid delay of the work. In no case should the work proceed without inspection of all roof deck areas and substantial agreement on all points.
   3. The following are to be accomplished during the conference:
      a. Review all Factory Mutual and Underwriters Laboratories requirements listed in the specifications and resolve any questions or conflicts that may arise.
      b. Establish trade-related job schedules, including the installation of roof-mounted mechanical equipment.
      c. Establish roofing schedule and work methods that will prevent roof damage.
      d. Require that all roof penetrations and walls be in place prior to installing the roof.
      e. Establish those areas on the job site that will be designated as work and storage areas for roofing operations.
      f. Establish weather and working temperature conditions to which all parties must agree.
      g. Establish acceptable methods of protecting the finished roof if any trades must travel across or work on or above any areas of the finished roof.
   4. The Architect shall prepare a written report indicating actions taken and decisions made at this pre-roofing conference. This report shall be made a part of the project record and copies furnished the General Contractor, and the Owner.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's unopened, labeled bundles, rolls or containers.

B. Store materials to avoid water damage, and store rolled goods on end. Comply with manufacturer's recommendations for job-site storage and protection.

1.07 FIELD CONDITIONS

A. The Roofing Contractor shall accept the substrate prior to installation of roofing system.

B. Do not install shingles, eave protection membrane or underlayment when surface, ambient air, or wind chill temperatures are below 45 degrees F (7 degrees C).

C. Proceed with Shingle work only when weather conditions are in compliance with manufacturer's current written instructions and recommendation and when substrate is completely dry.

1.08 WARRANTIES AND GUARANTEES

A. Roofing and Wind Warranty: Provide shingle manufacturer's warranty on installed work, agreeing to pay for repair or replacement of defective shingles and as necessary to eliminate leaks. Period of warranty is forty (40) years from date of substantial completion.
   1. Asphalt shingles shall resist blow-off or damage caused by wind speeds up to and including 120 mph, or that shown on structural drawings.

B. Special Project Guarantee: Provide 3 fully executed copies of "Roofing Guarantee" on the form included in the "General CONDITIONS" Section of the Project Manual, covering the work of this Section, including in part, roofing, concealed and exposed flashings, roof decking and/or

sheathing, insulation, gravel stops, roof expansion joints, and other accessories, etc., signed by the General Contractor.

C. Provide all necessary roof, and related, components to achieve specified warranty.

D. Repairs that become necessary, such as for leaks, wind damage or temperature stress while roofing is under warranty and/or guarantee, shall be performed by the installer within 7-days of notification. Should for any reason, the installer not be able to perform the repairs, it shall be incumbent upon the manufacturer to do so. If repairs are not begun on time, Owner shall have work done by others and costs will be charged to the Contractor, with no detrimental effect on the remaining warranty and no termination of warranty.

E. The above warranty and guarantee shall be in addition to, shall be in effect simultaneously with, and shall not alter or limit other project or product warranties or guarantees, nor shall they serve as limitations to other remedies available to the Owner.

F. Standard manufacturer's roofing warranties and guarantees which contain language regarding the governing of the warranties and guarantees by any state other than the State of Alabama, must be amended to exclude such language, and substituting the requirement that the Laws of the State of Alabama shall govern all such warranties and guarantees.
   1. Unless manufacturer's warranty agrees to arbitration through the American Arbitration Association or directly references State of Alabama for enforcement, manufacturer shall provide warranty rider stating that manufacturer's warranty is governed by and shall be enforced in accordance with laws of Alabama, and that in the event of a conflict between the provisions of the Warranty and the provisions of the rider, the provisions of the rider shall control.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers/Products: Subject to compliance with requirements, provide one (1) of the following, or preapproved equivalent submitted at least 10 days prior to original Bid date and subsequently approved:
   1. Certainteed: www.certainteed.com.
   2. GAF Materials Corporation; Product "Timberline HDZ" [Basis of Design] or "Stormguard": www.gaf.com.
   3. Owens Corning Corp: www.owenscorning.com.

2.02 WIND UPLIFT RESISTANCE

A. Roof System shall comply with FM 1-90 requirements for wind uplift resistance.

2.03 SHEET MATERIALS

A. Roofing Underlayment: Grace Ice and Water Shield self-adhered roofing membrane, or approved equivalent.

2.04 ACCESSORIES

A. Nails: Standard round wire shingle type, of hot-dipped zinc coated steel, 12 gage, 0.105 inch (2.67 mm), to 10 gage, 0.134 inch, shank diameter, 3/8 inch (9.5 mm) head diameter, of sufficient length to penetrate 3/4 inch (19 mm) into roof sheathing or decking, or as recommended by roof shingle manufacturer. Nail shall be continuous ring shank, and shall be provided by American nail supplier.
   1. The use of square-head nails, staples, and pneumatic or electric nail guns is strictly prohibited.

B. Roofing Nails: Standard round wire shingle type, galvanized steel, stainless steel, aluminum roofing nails, or copper roofing nails, minimum 3/8-inch (9.5 mm) head diameter, 12-gauge, 0.109-inch (2.77 mm) nail shank diameter, 1-1/2 inches (38 mm) long and complying with ASTM F1667/F1667M.

C. Asphalt Roof Cement: ASTM D4586/D4586M, asbestos-free.

D. Rigid Ridge Vent: Manufacturer's standard rigid section high-density polypropylene or other UV-stabilized plastic ridge vent with nonwoven geotextile filter strips and with external deflector baffles; for use under ridge shingles.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. GAF Materials Corporation; Cobra Rigid Vent III [Basis of Design], or comparable product by one of the following:
      b. Air Vent Inc., a CertainTeed Company; ShingleVent II.
      c. Owens Corning; VentSure Ridge Vent.
      d. Trimline Building Products; Trimline Ridge Vent.

E. Soffit Vent: Manufacturer's standard heat resistant polypropylene vent for use at eaves.
   1. Manufacturers: Subject ot compliance with requirements, provide products by one of the following:
      a. Cor-A-Vent; S-400 Strip Vent; [Basis of Design]: www.cor-a-vent.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

F. Use fasteners that comply with manufacturer's recommendations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to starting this work.

B. Verify roof deck is of sufficient thickness to accept fasteners.

C. Verify roof penetrations and plumbing stacks are in place and flashed to deck surface.

D. Verify roof openings are correctly framed.

E. Verify deck surfaces are dry, free of ridges, warps, or voids.

F. Verify that self-adhered membrane flashing used as underlayment (specified in Section 07 6200) has been installed over all substrates scheduled to receive it.

3.02 PREPARATION

A. Seal roof deck joints wider than 1/16 inch (1.5 mm) as recommended by shingle manufacturer.

B. At areas where eave protection membrane is to be adhered to substrate, fill knot holes and surface cracks with latex filler.

C. Broom clean deck surfaces before installing underlayment or eave protection.

D. Install eave edge flashings tight with fascia boards. Weather lap joints 2 inches (50 mm) and seal with plastic cement. Secure flange with nails spaced in accordance with NRCA standards.

3.03 INSTALLATION

3.04 INSTALLATION - FELT UNDERLAYMENT

A. Coordinate the installation of the following with the requirements of Sheetmetal Flashing and Trim Section, including in part, self-adhered membrane flashing (below felts), continuous metal drip edge, and other materials indicated or otherwise required by project conditions.
   1. Apply one layer felt horizontally over entire surface, lapping succeeding courses 4-inches minimum and fastening with sufficient nails to hold in place until shingle application. Overlap 4-inches minimum at all valleys and ridges.

B. Weather lap and seal watertight with plastic cement any items projecting through or mounted on roof.

3.05 INSTALLATION - ACCESSORIES

A. Install accessories in accordance with manufacturer's recommendations and NRCA requirements.

B. Items Projecting Through or Mounted on Roofing: Flash and seal weather tight with plastic cement.

3.06 FIELD QUALITY CONTROL

A. See Section 01 400 - Quality Requirements, for general requirements for field quality control and inspection.

B. Require site attendance of roofing and insulation material manufacturers daily during installation of the Work, and at completion of the Work.
   1. Roofing manufacture shall be on site when the roofing installation starts to observe the installation of the underlayment, flashing, and installation of shingles. Manufacture shall generate an observation report for this day and send out no later than 72 hours of observation.
   2. Roofing manufacture shall make a site visit in the middle of the roofing installation and once at completion. Report shall include list of corrections to be made. Distribution of all reports shall include contractor and architect and sent out no later than 72 hours of observation.

C. Materials representative shall provide a final inspection report to Contractor and Architect at completion of project.

3.07 CLEANING

A. Remove all trash, scraps, debris, etc., from roof and site, which results from work under this Section, and legally dispose of off-site.

3.08 PROTECTION

A. Do not permit traffic over finished roof surface; protect roofing until completion of project.

END OF SECTION

SECTION 07 4646
FIBER CEMENT PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wood-fiber cement board.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 04 2000 - Unit Masonry: Soffit substrate.

C. Section 05 4500 - Light Gauge Steel Trusses.

D. Section 061000 - Rough Carpentry: Soffit substrate.

1.03 REFERENCE STANDARDS

A. ASTM C1186 - Standard Specification for Flat Fiber Cement Sheets; 2008.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Manufacturer's requirements for related materials to be installed by others.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods, including nail patterns.

C. Test Report: Applicable model code authority evaluation report (e.g. ICC-ES).

D. Maintenance Instructions: Periodic inspection recommendations and maintenance procedures.

E. Warranty: Submit copy of manufacturer’s warranty, made out in Owner’s name, showing that it has been registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum 3 years of experience.

B. Mock-Up:
   1. Construct a representative wall sample, 6 feet wide by 10 feet high, which includes face brick, mortar and accessories, architectural masonry veneer, cast stone, metal-framed storefronts, with masonry back-up and metal stud and sheathing backup where applicable; with accompanying flashing, sealants, and waterproofing (air barrier). Also, eave condition, including soffit and gutter is included. This panel will be for the purpose of approving the wall system and its components.
   2. Locate where directed, or indicated.
   3. Coordinate with work of other Sections.
   4. Approved mock-up will become standard for appearance and workmanship.
   5. Mock-up may not remain as part of the completed work.
   6. Remove mock-up not incorporated into the work and dispose of debris.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products under waterproof cover and elevated above grade, on a flat surface.

PART 2 - PRODUCTS

2.01 FIBER CEMENT PANEL

A. Soffit, Facia, and Trim Panels: Panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186 Type A Grade II; with machined edges, for nail attachment.

1. Texture: Smooth.
2. Length: 96 inches (2400 mm), nominal.
3. Width: 48 inches (1220 mm).
4. Thickness: 1/4 inch (__ mm), nominal, for soffit panels; thickness as indicated on drawings for facia and trim.
5. Finish: Field Paint, color selected by Architect.
6. Manufacturers:
   a. CertainTeed Corporation : www.certainteed.com.
   b. James Hardie Building Products, Inc; [Basis of Design]: www.jameshardie.com.
   c. Nichiha USA, Inc : www.nichiha.com.
   d. Substitutions: See Section 01600 - Product Requirements.

2.02 ACCESSORIES

A. Trim: Same material and texture as siding.

B. Fasteners: Galvanized or corrosion resistant; length as required to penetrate minimum 1-1/4 inch (32 mm).

C. Joint Sealer: As specified in Section 079005.

D. Insect Screen.

E. Construction Adhesive.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine substrate and clean and repair as required to eliminate conditions that would be detrimental to proper installation.

B. Do not begin until unacceptable conditions have been corrected.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and recommendations.
   1. Read warranty and comply with all terms necessary to maintain warranty coverage.
   2. Install in accordance with conditions stated in model code evaluation report applicable to location of project.
   3. Use trim details indicated on drawings.
   4. Touch up all field cut edges before installing.
   5. Pre-drill nail holes if necessary to prevent breakage.
   6. Install insect screen over vents, using construction adhesive.

B. Over Steel Studs: Use hot-dipped galvanized self-tapping screws, with the points of at least 3 screws penetrating each stud the panel crosses and at panel ends.

C. Do not install siding less than 6 inches (150 mm) from surface of ground nor closer than 1 inch (25 mm) to roofs, patios, porches, and other surfaces where water may collect.

D. After installation, seal all joints except lap joints of lap siding. Seal around all penetrations. Paint all exposed cut edges.

E. Finish Painting: Specified in Section 09 9000.

3.03 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings and counterflashings.

B. Sealants for joints within sheet metal fabrications.

C. Self-Adhered Membrane Flashing.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: General requirements for mock-ups.

B. Section 07 7123 - Manufactured Gutters and Downspouts.

C. Section 09 9100 - Painting: Field painting.

1.03 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

D. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products; 2025.

E. CDA A4050 - Copper in Architecture - Handbook; Current Edition.

F. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit two samples, 6 by 6 inches (___ by ___ mm) in size, illustrating metal finish color.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with three years of documented experience.

C. Mock-Up:

1. Construct a representative wall sample, 6 feet wide by 10 feet high, which includes face brick, mortar and accessories, architectural masonry veneer, cast stone, metal-framed storefronts, with masonry back-up and metal stud and sheathing backup where applicable; with accompanying flashing, sealants, and waterproofing (air barrier). Also, eave condition, including soffit and gutter is included. This panel will be for the purpose of approving the wall system and its components.
2. Locate where directed, or indicated.
3. Coordinate with work of other Sections.
4. Approved mock-up will become standard for appearance and workmanship.
5. Mock-up may not remain as part of the completed work.

6. Remove mock-up not incorporated into the work and dispose of debris.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch (0.61 mm) thick base metal.

B. Lead Sheet: ASTM B749, 0.047-inch (1.19 mm) minimum thickness; UNS Number L51121.

C. Self-Adhering Flashing - Around Windows, Doors, and Critical Wall Penetrations: Self-adhesive, rubberized asphalt bonded to polyethylene film, cold applied tape, with silicone-coated release sheet; 40 mil thickness; 12" wide roll, or as required. Provide primer when recommended by flashing manufacturer.
   1. Advanced Building Products Inc.; Peel-N-Seal, : www.advancedflashing.com.
   2. Carlisle Coatings & Waterproofing, Inc.; CCW-705-TWF, : www.carlisle-ccw.com.
   3. Grace, W. R. & Co.; Ice & Water Shield Strips: www.na.graceconstruction.com.
   4. Grace, W. R. & Co.; Perm-A-Barrier Wall Flashing: www.na.graceconstruction.com.

2.02 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18-inch (450 mm) long legs; seam for rigidity, seal with sealant.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

2.03 SELF-ADHERED MEMBRANE FLASHING

A. Self-Adhered Membrane Flashing: Used as underlayment under Shingle Roofs and Metal Siding (Occurring Over Solid Substrates): Self-Adhering, Rubberized Asphalt bonded to Polyethylene-Film, 40 mils (1.0 mm) thick minimum, consisting of slip-resisting polyethylene-film reinforcing and top surface laminated to SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer. Thermal stability: Unaffected at -20 deg. F.; ASTM D 1970.
   1. Carlisle Coatings & Waterproofing, Inc.; Dri-Start "A": www.carlisle-ccw.com.
   2. Grace, W. R. & Co.; Ice and Water Shield [Basis of Design]: www.na.graceconstruction.com.
   3. Johns Manville International, Inc.; Roof Defender: www.jm.com.
   4. Owens Corning; WeatherLock Flex: www.owenscorning.com.

B. Self-Adhered Membrane Flashing - High Temperature: Used as underlayment under Metal Roof or Horizontal Applications of Metal (Occuring Over Solid Substrates): 30 mils thick minimum, slip-resisting polyethylene-film-reinforced top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer. Thermal stability: Stable after testing at 240 deg. F., and unaffected at -20 deg. F.; ASTM D 1970.
   1. Carlisle Coatings & Waterproofing, Inc.; CCW WIP 300HT, : www.carlisle-ccw.com.
   2. CertainTeed Corporation; WinterGuard HT: www.certainteed.com.

3. Grace, W.R. & Co.; Ultra [Basis of Design]: www.na.graceconstruction.com.
4. Henry Company; Blue Skin PE-200HT: www.henry.com.

C. Install 1-layer over substrate surface at the following locations:
1. 36-inches wide in all valleys, over all hips and ridges (18-inches on each side of each valley, hip ridge, and top ridge), and at perimeter edges of shingle roof planes.
2. Below all metal roofing, and behind any metal wall panels and metal siding.
3. Where roofing planes intersect vertical walls and planes, turn edges up at least 8-inches.
4. Cover sheathing at corners.
5. Wrap head, jambs, and sill of all punched openings.

D. Coordinate with, and refer to Division 7 Roofing and Siding Sections for additional information and requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch (0.38 mm).

3.03 INSTALLATION

A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Seal metal joints watertight.

E. Install continuous through-wall flashing and sub-sill flashing with interior end dam prior to setting doors and windows. Typical at head and sill conditions. Jamb flashing to terminate in sub-sill flashing. Install metal head flashing at all window and door heads per manufacturer's standard detail.

F. Where sloping roof abutts a wall, integrate metal step flashing into the shingleroofing in accordance with best industry standards to provide weathertight joint.

G. Apply Self-Adhered Membrane Flashing used as underlayment in accordance with manufacturer's recommendations.
1. Lap in shingled manner.
2. Flash perimeter of wall openings.
3. Cover internal and external corners with additional layer of self-adhered membrane flashing.

H. Apply self-adhered flashing in accordance with manufacturer's recommendations.

END OF SECTION

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SECTION 07 7123
MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prefinished Aluminum-zinc alloy coated steel gutters and downspouts.

B. Splash guards.

1.02 RELATED REQUIREMENTS

A. Section 07 3113 - Asphalt Shingles: Sloped roofing system.

B. Section 07 6200 - Sheet Metal Flashing and Trim.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Comply with SMACNA (ASMM) for sizing components for rainfall intensity determined by a storm occurrence of 1 in 5 years.

B. Comply with applicable code for size and method of rain water discharge.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

1.06 QUALITY ASSURANCE

A. Mock-Up:
   1. Construct a representative wall sample, 6 feet wide by 10 feet high, which includes face brick, mortar and accessories, architectural masonry veneer, cast stone, metal-framed storefronts, with masonry back-up and metal stud and sheathing backup where applicable; with accompanying flashing, sealants, and waterproofing (air barrier). Also, eave condition, including soffit and gutter is included. This panel will be for the purpose of approving the wall system and its components.
   2. Locate where directed, or indicated.
   3. Coordinate with work of other Sections.
   4. Approved mock-up will become standard for appearance and workmanship.
   5. Mock-up may not remain as part of the completed work.
   6. Remove mock-up not incorporated into the work and dispose of debris.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Stack material to prevent twisting, bending, or abrasion and to provide ventilation. Slope to drain.

C. Prevent contact with materials that cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pre-finished Aluminum Sheet: ASTMB209, 0.040 inch thickness.
   1. Finish: Plain, shop pre-coated with PVDF (polyvinylidine fluoride) coating.
   2. Color: As indicated.

B. Primer: Zinc Molybdate Type.

C. Protective Backing Paint: Zinc Molybdate Alkyd.

2.02 GUTTERS AND DOWNSPOUTS

A. Gutters: Profile as indicated, or 6x6 inches, if not indicated.

B. Downspouts: Profile as indicated or 3.75 x 4.75 inches, if not indicated.

C. Anchors and Supports: Profiled to suit gutters and downspouts.
   1. Anchoring Devices: Type recommended by fabricator.
   2. Gutter Supports: Straps, unless indicated otherwise.
   3. Downspout Supports: Brackets, unless indicated otherwise.
      a. Provide minimum of 3 locations: top, middle and bottom, unless fabricator or SMACNA recommends more.
   4. Material: Same material as gutters and downspouts, unless fabricator recommends otherwise.

D. Fasteners: Same material and finish as gutters and downspouts, unless fabricator recommends otherwise.

E. Gutter dropouts at each downspout location. Filter screen shall be installed at each downspout location.

2.03 ACCESSORIES

A. Splash Pads: Precast concrete type, profile size(s) as indicated; minimum 3,000 psi (21 MPa) compressive strength at 28 days, with minimum 5 percent air entrainment.

2.04 ACCESSORIES

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify surfaces are acceptable for product installation in accordance with manufacturer's written instructions.

3.02 PREPARATION

A. Paint concealed sheet metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to minimum dry film thickness of 15 mils, 0.015 inch (0.381 mm).

3.03 INSTALLATION

A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.

B. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.

C. Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution, and rinse with water.

D. Set splash pans under downspouts.

END OF SECTION

SECTION 07 7230
EAVE VENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Eave vents.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to the work of this Section.

B. Section 06 1000 - Rough Carpentry.

C. Section 07 7100 - Roof Specialties.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 3000.

B. Product Data: Manufacturer's catalog data, standard details, and installation instructions.

C. Samples: 2 inch long samples of each profile required.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store products indoors and protect from construction traffic and damage.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Manufacturer: Provide vents fabricated by Cor-A-Vent, Inc.; P.O. Box 428; Mishawaka, IN 46546: www.cor-a-vent.com.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Eave Vents: Cor-A-Vent PS-400 Strip Vent [Basis of Design].
   1. Net free area: 10 sq in per lin ft.
   2. Dimensions: 1 inch wide by 48 inches long by 3/4 inch high.
   3. Color: As selected by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that framing is in place with proper clearance to receive vents.

3.02 INSTALLATION

A. Install eave vents in accordance with manufacturer's instructions.

3.03 EAVE VENTS

A. Install continuous vents full length of soffits, unless otherwise indicated.

B. Ensure that adequate blocking or barriers are installed to prevent insulation from impeding air flow.

3.04 ADJUST AND CLEAN

A. Remove any scrap from the site, and leave in a neat and clean condition.

END OF SECTION

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SECTION 07 8400
FIRESTOPPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Work described in this Section includes:
   1. Through penetration firestopping in fire rated construction.
   2. Construction-gap firestopping at connections of the same materials and different materials in fire rated construction.
   3. Construction-gap fire stopping occurring within fire rated wall, floor, floor-ceiling, and/or roof-ceiling assemblies.
   4. Construction-gap firestopping at the top of fire rated walls.
   5. Through-penetration smoke-stopping in smoke partitions.
   6. Construction-gap smoke-stopping in smoke partitions.

B. Related work Specified elsewhere includes:
   1. For structural, finish, and fire protection materials: Refer to the appropriate Specifications Sections.
   2. Fire dampers and manufactured devices: Refer to Divisions 21-23.
   3. Raceway seals and manufactured electrical devices: Refer to Division 26.

C. Unless specifically indicated otherwise, the party, trade, or subcontractor whose work penetrates fire-rated construction and/or fire-rated assemblies, shall be responsible for firestopping around their own penetrations.

D. In the event the General Contractor employs a Specialty Subcontractor for the required firestopping work, they shall notify all prospective Bidders, so as to avoid duplication in pricing.
   1. The Specialty Subcontractor shall provide coordination of requirements and the related work of other trades in advance of and as the Work progresses.

1.03 REFERENCED STANDARDS

A. Underwriters Laboratories - U.L. Fire Resistant Directory:
   1. Through-penetration fire stop devices (XHCR); Firestop Devices (XHJI).
   2. Fire resistant ratings (BXUV) (BXRH).
   3. Through-penetration firestop systems (XHEZ).
   4. Fill, void, or cavity material (XHHW).
   5. Joint Systems (XHBN) & Perimeter Fire Containment Systems (XHDG).

B. American Society for Testing and Materials Standards:
   1. ASTM E 814: Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
   2. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. ASTM E 1966: Standard Test Method for Fire Resistive Joints Systems.
   4. ASTM E 2307: (Perimeter).

C. Underwriters Laboratories, Inc.:
   1. UL 1479: Fire Tests of Through-Penetration Firestops.
   2. UL 2079: Tests for Fire Resistance of Building Joint Systems.
   3. UL 723: Surface Burning Characteristics of Building Materials.

D. NFPA 101 - Life Safety Code / NFPA 70 - National Electrical Code.

1.04 DEFINITIONS

A. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.

B. Barriers: Time rated fire walls, smoke barrier walls, time rated floor-ceiling and roof-ceiling assemblies, and structural floors and walls.

C. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gasses, and smoke.

D. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.

E. Construction Gaps: Gaps between adjacent sections of walls, exterior walls, at wall tops between top of wall and ceiling, and structural floors or roof decks; and gaps between adjacent sections of structural floors.

F. System: Specific products and applications, classified and numbered by Underwriters Laboratories, Inc., to close specific barrier penetrations.

G. Sleeve: Metal fabrication or metal pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

1.05 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Fire Rated Construction: Maintain barrier and structural floor fire ratings including resistance to cold smoke at all penetrations, connections with other surfaces and/or types of construction, at separations required to permit building movement and sound and/or vibration absorption, and at other construction gaps.
   2. Smoke Barrier Construction: Maintain barrier and structural floor resistance to cold smoke at all penetrations, connections with other surfaces and types of construction and at all separations required to permit building movement and sound and/or vibration absorption, and at other construction gaps.

1.06 SUBMITTALS

A. Submit in accordance with General Conditions, Division 1, and Section 01 0150 - “Special Conditions,” unless specifically indicated otherwise.

B. Product Data: Manufacturer’s written specifications and technical data including the following:
   1. Detailed specifications of construction and fabrication.
   2. Manufacturer’s current written installation instructions.
   3. Summary of test data for each product intended for use and limitations. Include name and address of the required independent testing laboratory and compliances obtained.

C. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.
   1. Details of each proposed assembly identifying intended products and applicable UL System number or UL Classified devices.
   2. Manufacturer or manufacturers representative shall provide qualified engineering judgments and drawings relating to non-standard applications as needed.

D. Quality Control Submittals: Statement of qualifications.

E. Applicators’ Qualifications Statement: List past projects indicating required experience.

1.07 QUALITY ASSURANCE

A. Specialty Contractor’s Qualifications: Firm experience in installation or application of systems similar in complexity to those required for this project, plus the following:
   1. Acceptable to or licensed by manufacturer, and to State, Local, and/or other authority having jurisdiction, where applicable.

2. At least 2-years experience with systems intended for use.
3. Successfully completed at least five projects of similar size, scope, and complexity using the systems intended for use.

B. Local and State Regulatory Requirements: Submit forms or acceptance for proposed assemblies not conforming to specific UL Firestop System Numbers or UL classified devices and/or systems. Engineering judgment documents must follow requirements set forth by the International Firestop Council.

C. Materials shall have been tested to provide fire rating at least equal to that of the construction.

1.08 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping:
1. Deliver products in original unopened packaging with legible manufacturer's identification.
2. Coordinate delivery with scheduled installation date, so as to allow minimum storage at site.

B. Storage and Protection: Store materials in a clean, dry, ventilated interior location. Store materials off of floor, and protect from soiling, abuse, moisture, and freezing. Follow manufacturer's written instructions when more stringent.

C. Remove damaged and/or contaminated materials immediately, legally dispose of off site, and Replace, at Contractor's expense.

1.09 PROJECT CONDITIONS

A. Existing Conditions:
1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding with work.
2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

B. Environmental Requirements:
1. Furnish adequate ventilation if using solvents.
2. Furnish forced air ventilation during installation if required by manufacturer and/or authorities having jurisdiction.
3. Keep Flammable materials away from sparks or flame.
4. Provide masking or drop cloths to prevent contamination of adjacent surfaces by firestopping materials.
5. Comply with manufacturer's written recommendations for temperature and humidity conditions before, during, and after installation of firestopping.

1.10 GUARANTEE

A. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, co-adhesion, abrasive resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, and/or general durability, and/or which appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality or characteristic of the material for the exposure indicated. The guarantee period shall be for 1-year from the date of "Substantial Completion."

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS AND PRODUCTS

A. Use only those listed in the UL Fire Resistance Directory for the UL System involved.

B. Products shall be as manufactured by one of the following , or pre-approved equivalent:
1. Dow Corning.
2. HILTI.
3. 3M Fire Protection Products.
4. Nelson Firestop Products.
5. Rector Seal Corp.; "Metacaulk" [Basis of Design]: www.rectorseal.com.

6. Specified Technologies, Inc.
7. Tremco, Div. of RPM Corporation.

C. All firestopping products must be from a single manufacturer.

D. All trades shall use products from the same manufacturer.

2.02 THROUGH-PENETRATION FIRESTOPPING OF FIRE-RATED CONSTRUCTION

A. Systems or devices listed in the UL Fire Resistance Directory under categories XHCR (XHJI) and XHEZ may be used, providing that they conform to the construction type, penetrant type, annular space requirements, and fire rating involved in each separate instance, and that the system be symmetrical for wall applications. Systems or devices must be asbestos-free.
   1. Additional requirements: Withstand the passage of cold smoke either as an inherent property of the system, or by the use of a separate product included as a part of the UL system or device, and designated to perform this function.

2.03 CONSTRUCTION-GAP FIRE STOPPING OF FIRE-RATED CONSTRUCTION

A. Firestopping at construction gaps between edges of floor slabs and exterior wall construction.

B. Firestopping at construction gaps between tops of partitions and under side of structural systems.

C. Firestopping at construction gaps between tops of partitions and underside of fire-rated ceiling or ceiling assembly.

D. Firestopping of control joints in fire rated masonry partitions.

E. Firestopping expansion joints.

F. Acceptable manufacturers and products: Use only those listed in the UL Fire Resistant Directory for the UL System involved.

2.04 SMOKE STOPPING AT SMOKE PARTITIONS

A. Through-penetration smoke-stopping: Any system complying with the requirements for through-penetration firestopping in fire-rated construction, as specified in the “Referenced Standards” is acceptable, provided that the system includes the specified smoke seal or will provide a smoke seal. The length of time of the fire resistance may be disregarded, as applicable.

B. Construction-gap smoke-stopping: Any system complying with the requirement for construction-gap firestopping in fire-rated construction, as specified in the “Referenced Standards” is acceptable, provided that the system includes the specified smoke seal or will provide the smoke seal. The length of time of the fire resistance may be disregarded, as applicable.

2.05 ACCESSORIES

A. Fill, void, and cavity materials: As classified under category XHHW in the UL Fire Resistance Directory.

B. Forming materials: As classified under category XHKU in the UL Fire Resistance Directory.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion. Notify the General Contractor of such conditions.
   1. Verify barrier penetrations are properly sized and in suitable conditions for application of materials.
   2. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 PREPARATION AND CLEANING

A. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose materials, rust or other substances, that may effect proper fitting, adhesion, or the required fire resistance.

3.03 INSTALLATION

A. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's written instructions and recommendations.

B. Seal holes or voids made by penetrations to ensure an effective smoke barrier.

C. Where floor openings without penetrating items are more than 4-inches in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as required for floor system.

D. Protect materials from damage on surfaces subject to traffic.

E. Place firestopping in annular space around fire dampers before installation of damper's anchoring flanges, which are to be installed in accordance with fire damper manufacturer's written recommendations, unless specifically indicated otherwise.

F. Where large openings are created in walls, or floors to permit installation of pipes, ducts, cable tray, bus duct, or other items, close unused portions of opening with firestopping material tested for the application.

G. Install smoke firestopping as specified for firestopping.

H. Where rated walls are constructed with horizontally continuous air space, double width masonry, or double stud frame construction, provide vertical, 12-inch wide fiber dams for full thickness and height of air cavity at maximum intervals of 15'-0" on center.

3.04 FIELD QUALITY CONTROL

A. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by the Architect, building inspector, fire inspector, and/or other authority having jurisdiction.

C. Perform under this Section patching and repairing of firestopping caused by cutting or penetration by other trades, and/or by any other cause.

3.05 ADJUSTING AND CLEANING

A. Immediately clean-up spills of liquid components.

B. Neatly cut and trim materials as required.

C. Remove equipment, materials and debris, leaving area in undamaged and clean condition.

D. Legally dispose of excess materials, trash, debris, etc., off of site.

END OF SECTION

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SECTION 07 9005
JOINT SEALERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 07 1400 - Fluid-Applied Air Barrier: Sealants required in conjunction with substrates for fluid-applied waterproofing.

C. Section 07 8400 - Firestopping: Firestopping sealants.

D. Section 08 8000 - Glazing: Glazing sealants and accessories.

1.03 REFERENCE STANDARDS

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with other sections referencing this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Samples: Submit two samples, 6 by 6 inch (____x____ mm) in size illustrating sealant colors for selection.

D. Submit results of field sealant adhesion testing to Architect prior to start of work.

E. Manufacturer's Installation Instructions: Indicate special procedures.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

C. Verify sealant system is compatible with substrate before installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 - PRODUCTS

2.01 MANUFACTURERS/PRODUCTS

A. Type 1 - Silicone Sealants:
   1. Pecora Corporation; 890NST Ultra Low Modulus Architectural Silicone Sealant - Class 100: www.pecora.com.
   2. Dow Corning; Product 790: www.dowcorning.com.
   3. Tremco Global Sealants; Product Spectrem 1: www.tremcosealants.com.

B. Type 2 - Silicone Sealants:
   1. Dow Corning; Product 795: www.dowcorning.com.
   2. Pecora Corporation; Product 895: www.pecora.com.

3. Tremco Global Sealants; Product Spectrem 2: www.tremcosealants.com.

C. Type 3 - Polyurethane Sealants:
1. Sika Corporation; Product Sika Flex 2C: usa.sika.com.
2. Tremco; Dymeric 240 FC: www:tremcosealants.com.

D. Acrylic Sealants (ASTM C920):
1. Tremco Global Sealants: www.tremcosealants.com.
2. Red Devil; Siliconized Acrylic Construction Grade (35 Year) Sealant: www.reddevil.com.
3. Sherwin-Williams Company; Shermax Urethanized Elastomeric Sealant: www.sherwin-williams.com.

E. Butyl Sealants:
1. Bostik Inc: www.bostik-us.com.
2. Pecora Corporation: www.pecora.com.
3. Tremco Global Sealants: www.tremcosealants.com.
4. Substitutions: See Section 01600 - Product Requirements.

2.02 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Backing For Exterior Silicone Sealants: Jacketed, bi-cellular polyolefin "soft-rod" backer rods, as manufactured by ITP, Nomaco, or approved equal.

2.03 MISCELLANEOUS MATERIALS

A. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated.

B. Cleaners for Nonporous Surfaces: Provide non-staining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials which are not harmful to substrates and adjacent nonporous materials.

C. Masking Tape: Provide non-staining, non-absorbent type compatible with joint sealants and to surface adjacent to joints.

D. Expansion Joint Filler: Multi-purpose, Expansion-Contraction Joint Filler for slab joints. Thickness: 1/2 inch, unless indicated otherwise. Equal to W.R.Meadows Fibre Expansion Joint.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 FIELD QUALITY CONTROL

A. Perform field sealant testing for all exterior sealants that affect watertightness.
1. Test each material scheduled as a substrate for silicone sealants to verify substrate priming and preparation requirements.
2. Field sealant adhesion testing shall be performed by authorized representative of selected sealant manufacturer.
3. Submit results of field sealant adhesion testing to Architect prior to start of work.
4. Coordinate results of testing so that substrate preparation and priming requirements are known at time when needed by sealant applicator before sealant installation.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect sealants until cured.

END OF SECTION

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SECTION 08 1113
STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 08 7100 - Door Hardware.

C. Section 09 9100 - Painting: Field painting.

1.02 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2025.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2025.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

I. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2026.

J. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

K. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.

L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

M. DHI A115 Series - Specifications for Steel Doors and Frame Preparation for Hardware; Door and Hardware Institute; 2000 (ANSI/DHI A115 Series).

N. ITS (DIR) - Directory of Listed Products; Current Edition.

O. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

P. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2024.

Q. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.

R. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

S. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

T. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

U. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.

V. UL (DIR) - Online Certifications Directory; Current Edition.

W. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Provide doors and frames complying with Steel Door Institute “Recommended Specifications: Standard Steel Doors and Frames” (SDI-100) and as herein specified.

C. Provide steel doors and frames from a single manufacturer.

D. Fire-Rated Door Assemblies:
   1. Where fire-rated door assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 “Standard for Fire Doors and Windows,” and have been tested, listed and labeled in accordance with ASTM E 152 “Standard Methods of Fire Tests of Door Assemblies” by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.
   2. Labels mounted on doors and door frames must indicate the time rating of the door/frame assembly.
   3. Provide units listed and labeled by UL.
   4. Attach fire rating label to each fire-rated unit.
   5. Fire rating label must be accessible, permanent (embossed on metal label), and be kept legible at all times.
   6. Labels on frames with transoms or sidelights must identify that the opening assembly includes same.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

C. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage.

D. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided finish items are equivalent in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

E. Store doors and frames at building site under cover. Place units on minimum 4-inch-high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4-inch spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Steel Doors and Frames, (General):
   1. Ceco Door: www.cecodoor.com.
   2. Curries, Mason City, Iowa: www.curries.com.
   3. Mesker Industries, Inc.
   4. Republic Builders Products Corp./Subs. Republic Steel.

B. Substitutions: Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.

3. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
4. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
5. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

B. Materials:
1. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.
2. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM SA 568.
3. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, with ASTM A 525, G60 zinc coating, mill phosphatized.
4. Supports and Anchors: Fabricate of galvanized sheet steel of gage not less than that of door frame.
5. Inserts, Bolts and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.

C. Fabrication:
1. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at project site.
2. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel (at fabricator's option).
3. Fabricate exterior doors, panels and frames from galvanized sheet steel. Close top and bottom edges of exterior doors as integral part of door construction or by addition of minimum 16-gauge inverted steel channels.
    a. Use galvanizing repair paint for surfaces damaged by fabrication or welding.
4. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws and bolts.
5. Finish Hardware Preparation:
    a. Prepare doors and frames to receive mortise and concealed finish hardware in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A 115 series specifications for door and frame preparation for hardware.
    b. Reinforce doors and frames to receive surface applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.
    c. Locate finish hardware as indicated on final shop drawings, or if not indicated, in accordance with “Recommended Locations for Builders' Hardware,” published by Door and Hardware Institute.
6. Shop Painting:
    a. Clean, treat and paint exposed surfaces of steel door and frame units, including galvanized surfaces.
    b. Clean steel surfaces of mill scale, rust, oil, grease, dirt and other foreign materials before application of paint.
    c. Use galvanizing repair paint for surfaces damaged by fabrication or welding, prior to prime coat.

d. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.
e. Do not paint fire labels on doors or frames.

D. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Provide metal doors of types and styles indicated on drawings or schedules, or seamless hollow steel construction. Form exterior doors of hot dip galvanized steel.

B. Exterior Doors, Non-Fire-Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 3 - Extra Heavy-duty.
b. Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 1 - Full Flush.
d. Door Face Metal Thickness: 20 gage, 0.032 inch (0.8 mm), minimum.
2. Core Material: Polystyrene, 1 lbs/cu ft minimum density.
3. Top Closures for Outswinging Doors: Flush with top of faces and edges.
4. Door Face Sheets: Flush.

C. Exterior Doors, Fire-Rated:
1. Grade: ANSI A250.8 - SDI-100; Level 3 - Extra Heavy-Duty, Physical Performance Level A, Model 1 - Full Flush.
2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").
a. Provide units listed and labeled by UL (Underwriters Laboratories) - UL (BMD).
b. Attach fire rating label to each fire rated unit.
3. Door Face Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
4. Core: Mineral board.
5. Thickness: 1-3/4 inch (44.5 mm).
6. Top Closures : Flush with top of faces and edges.
7. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
8. Texture: Smooth faces.

D. Interior Doors, Non-Fire Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 2 - Heavy-duty.
b. Physical Performance Level B 500 000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 1 - Full Flush.
d. Door Face Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

E. Fire-Rated Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 2 - Heavy-duty.
b. Physical Performance Level B 500 000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 1 - Full Flush.
d. Door Face Metal Thickness: 20 gage, 0.032 inch (0.8 mm), minimum.

2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
   a. Provide units listed and labeled by UL (DIR) or ITS (DIR).
   b. Attach fire rating label to each fire rated unit.
3. Core Material: Mineral board.
4. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. General:
   1. Comply with the requirements of grade specified for corresponding door.
      a. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricated frames of minimum 16-gauge cold-rolled furniture steel for interior door frames; 14-gauge cold-rolled furniture steel for exterior door frames.
         1) Frames for doors 7'-10" or more in height and/or over 3'-5" in width: 14 gauge cold-rolled furniture steel, and one additional hinge, whether or not indicated in hardware schedule.
   2. Frames shall be formed by press brake with corners sharp and true. Corners shall be mitered and accurately fitted, and shall be fully electrically welded and then ground smooth. Removable spreaders shall be welded to the bottom of the frame. Frames shall be accurately mortised for hardware.
   3. Contractor shall verify width of throat opening required, before fabrication.
   4. A minimum of three wall anchors shall be provided at each jamb, except four at doors 7'-10" high or more, and six at doors 10-foot high or more. Anchors shall be attached to door frames, adjustable, suitable for wall conditions and job requirements, and shall be 16 gauge minimum. Floor anchors shall be provided and welded to foot of each jamb with two 5/16" holes for securing to the floor.
   5. Reinforcements of adequate gauge shall be provided for strikes, closers and brackets and other surface applied hardware for field drilling and tapping.

C. Exterior Door Frames: Fully welded type.
   1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
   2. Weatherstripping: Separate, see Section 08 7100.

D. Interior Door Frames: Fully welded type.

E. Interior Door Frames, Fire-Rated: Fully welded type.
   1. Fire Rating: Same as door, labeled.

F. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

G. ////////Frames for Fiberglass Reinforced Polyester Doors (FRP). Fully welded type.
   1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.

H. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

I. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

J. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches (102 mm) high to fill opening without cutting masonry units.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

A. Glazing: As specified in Section 08 8000 - Glazing.

B. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches (102 mm) as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

C. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
   1. Provide additional door silencers at doors over 3'-0" wide or 7'-0" in height.
   2. Provide silencers equivalent to "GJ64" silencers as manufactured by Glenn-Johnson Corp., for metal frames, when not provided under the work of Section 08 7100 - "Finish Hardware."

D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

2.07 FINISHES

A. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating. This coating shall be factory installed on all interior of all hollow metal frames. Field application is not acceptable.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. General: Install standard steel doors, frames and accessories in accordance with final shop drawings and manufacturer's data, and as herein specified.

B. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

C. Install fire rated units in accordance with NFPA 80.

D. Coordinate frame anchor placement with wall construction.

E. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

F. Placing Frames:
   1. Comply with provisions of SDI-1-06 “Recommended Erection Instructions for Steel Frames,” unless otherwise indicated.
   2. Remove before installation all spreader bars and braces used for shipping.
   3. Except for frames located at in-place concrete or masonry, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces leaving surfaces smooth and undamaged.
   4. In masonry construction, locate a minimum of 3 wall anchors per jamb at hinge and strike levels. Add 1 wall anchor per jamb at hinge and strike levels for each whole 1'-10" height increment over 6'-0"; Similar at glazed and cased openings.

5. At in-place concrete or masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices.
6. In metal stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. Attach wall anchors to studs with tapping screws. Add additional anchors as indicated in paragraphs above.
7. Install fire-rated frames in accordance with NFPA Std. No. 80

G. Door Installation:
1. Fit hollow metal doors accurately in frames, within clearances specified in SDI-100.
2. Place fire-rated doors with clearances as specified in NFPA Std. No. 80.

H. Install silencers after all painting of doors and frames has been completed.

I. Install door hardware as specified in Section 08 7100.

J. Comply with glazing installation requirements of Section 08 8000.

K. Coordinate installation of electrical connections to electrical hardware items.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Prime Coat Touch-up:
1. Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.
2. Use galvanizing repair paint for galvanized surfaces, prior to prime coat.

C. Final Adjustments: Check and readjust operating finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

D. Repair all dents, bends, and prying prior to painting.

3.06 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

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SECTION 08 1416
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire-rated, non-rated, and acoustical.

1.02 RELATED REQUIREMENTS

A. Section 06 2000 - Finish Carpentry: Wood door frames.

B. Section 06 4000 - Architectural Woodwork: Millwork.

C. Section 08 1113 - Steel Doors and Frames.

D. Section 08 7100 - Door Hardware.

E. Section 08 8000 - Glazing .

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

C. ITS (DIR) - Directory of Listed Products; Current Edition.

D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025, with Amendment (2024).

E. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

F. UL (DIR) - Online Certifications Directory; Current Edition.

G. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, identify cutouts for glazing and louvers.

D. Samples: Submit two samples of stain colors, 6 x 6 inches minimum - on actual veneer chosen, for Architect to use to select stain color.

E. Verification Samples: Submit two samples of door veneer, minimum 24 x 24 inches in size illustrating wood grain, stain color, and sheen.

F. Manufacturer's Installation Instructions: Indicate special installation instructions.

G. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

B. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Haley Brothers: www.haleybros.com/#sle.
   2. Oshkosh Door Company: www.oshkoshdoor.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS

A. Doors: See drawings for locations and additional requirements.
   1. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with NFPA 252, UL 10B, or UBC Standard 7-2-94 ("neutral pressure"); UL or WH (ITS); Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
      a. Labeling of Fire Doors:
         1) Attach fire rating label to each fire rated unit.
         2) Fire rating label must be accessible, permanent (embossed on metal label), kept legible at all times, and shall contain the fire resistance rating in hours and/or minutes.
   3. Wood veneer facing with factory transparent finish.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

C. Sound-Rated Doors: Equivalent to type, with particleboard core (PC) construction as required to achieve STC rating specified; plies and faces as indicated above.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: White birch, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, center balance match of spliced veneer leaves assembled on door or panel face; unless otherwise indicated.
   1. Vertical Edges: Any option allowed by quality standard for grade.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

E. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

B. Factory finish doors in accordance with specified quality standard.
   1. Transparent Finish: Transparent catalyzed polyurethane, Premium quality, minimal sheen.
   2. Stain color shall match Architect's sample.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Coordinate installation of glazing.

3.03 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

END OF SECTION

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SECTION 08 3100
ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Access door and frame units, fire-rated and non-fire-rated, in wall and ceiling locations.

B. Attic Hatch.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 07 9005 - Joint Sealers.

C. Section 09 2116 - Gypsum Board Assemblies: Openings in gypsum ceilings or partitions.

D. Section 09 9100 - Painting: Field paint finish.

E. Divisions 22-26 Sections: Additional access doors provided and installed by Contractors for Plumbing, Mechanical, Electrical and related work.

1.03 SUMMARY

A. This Section includes access doors for installation in the following types of new construction:
   1. Gypsum drywall.
   2. Unit masonry.
   3. As otherwise indicated.

B. Provide fire-rated access doors where indicated or scheduled, and at access openings in all walls of stairs, elevator shafts and equipment rooms, other shafts and plumbing chase walls which are partially or fully open through floors, and at walls and ceilings indicated or required by Code to be fire-rated.

1.04 REFERENCE STANDARDS

A. UL (FRD) - Fire Resistance Directory; Current Edition.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
   1. Include complete schedule, including types, general locations, sizes, wall and ceiling construction details, finishes, latching or locking provisions, and other data pertinent to installation.

C. Shop Drawings: Indicate exact position of all access door units. Also indicate fabrication and installation of customized access doors and frames, including details of each frame type, elevations of door design types, anchorage and accessory items.

D. Manufacturer's Installation Instructions: Indicate installation requirements.

E. Project Record Documents: Record actual locations of each access unit.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire rated access doors.
   1. Provide access doors of fire rating equivalent to the fire rated assembly in which they are to be installed.
   2. Provide products listed and labeled by UL as suitable for the purpose specified and indicated.

B. Fire-Resistance Ratings: Wherever a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in Underwriters Laboratories, Inc.'s “Building Materials Directory” for rating shown.

1. Provide UL label on each fire-rated access door.
2. Fire rating label must be accessible, permanent (embossed on metal label), kept legible at all times, and shall contain the fire resistance rating in hours and/or minutes.

1.07 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain access doors for entire project from one source from a single manufacturer.

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard size units, which may vary slightly from sizes indicated.

C. Coordination: Furnish inserts and anchoring devices that must be built into other work for installation of access doors. Coordinate delivery with other work to avoid delay.

1.08 PROJECT CONDITIONS

A. Coordinate the work with other work requiring access doors.

B. Verification: Obtain specific locations and sizes for required access doors from trades requiring access to concealed equipment, and indicate on submittal schedule.

C. Special-Size Access Doors: Use where required or requested; indicate on schedule.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Wall and Ceiling Access Doors:
1. Acudor Products Inc: www.acudor.com.
2. Bar-Co., Inc.
3. Cesco Products
4. J.L. Industries [Basis of Design]: www.activarcpg.com/jl-industries/.
5. Karp Associates, Inc: www.karpinc.com.
6. Larsens Manufacturing Co.
7. Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.com.
8. Nystrom: www.nystrom.com.
9. The Williams Brothers Corp.
10. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ATTIC HATCH

A. Nystrom Building Products: www.nystrom.com. Product: NT, Steel Access Door, 36 inch by 36 inch, with 1 inch flange at perimeter, constructed of 14 gauge steel at door, 16 gauge at frame. 1 year warranty. Powder coat. For ceiling mount. Latch: As selected by Architect.
1. Substitutions: See Section 01 6000 - Product Requirements.

B. SP Partners, LLC.: www.rainbowatticstair.com. Product: F Series Steel Access Ladders. Must be able to hold a minimum live load of 500 pounds. Ladder to be 14
1. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESS DOORS AND PANELS

A. All Units: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.

B. Units in Fire Rated Assemblies: Fire rating equivalent to the fire rated assembly in which they are to be installed.

2.04 MATERIALS AND FABRICATION: ACCESS DOOR UNITS - WALLS AND CEILINGS

A. Door and Frame Units: Formed steel.
1. General: Furnish each access door assembly manufactured as an integral unit, complete with all parts, and ready for installation.
2. Steel Access Doors and Frames: Fabricate units of continuous welded steel construction, unless otherwise indicated. Grind welds smooth and flush with adjacent surfaces.

Furnish attachment devices and fasteners of type required to secure access panels to types of support shown.

3. Frames and flanges: 0.058 inch (1.5 mm) steel.
   a. Fabricate frame with exposed flange, nominal 1-inch wide around perimeter of frame for units installed in the following construction:
      1) Exposed masonry.
      2) Exposed concrete.
      3) Exposed siding.
   b. For gypsum drywall or gypsum veneer plaster, furnish perforated flange frames with drywall bead.
   c. For full-bed plaster and E.I.F.S. applications, furnish frames with galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.
4. Door panels: 0.070-inch single thickness steel sheet.
   a. Painted Flush Panel Doors (non-fire-rated and fire-rated): Fabricate from not less than 16-gage galvanized sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees. Finish with manufacturer's factory-applied prime paint.
      1) Restore any damage to galvanized finish with cold-process galvanizing repair paint, prior to applying factory prime coating, or other finishes.
   b. Stainless Steel Flush Panel Doors: Fabricate from not less than 18-gage stainless steel sheet, with concealed spring hinges or concealed piano hinge set to open 175 degrees. Buff exposed surfaces to #4 satin finish, except where other finishes are indicated.
5. Size: As indicated or as necessary to access and service equipment.
6. Hardware:
   a. Hardware for Fire-Rated Units: As required for listing.
   b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
   c. Hinge: 175 degree steel piano hinge with removable pin.
   d. Latch/Lock: Screw driver slot for quarter turn cam latch.
7. Galvanized, hot dipped finish, except where indicated otherwise.
8. Finish: No. 4 finish for stainless units.

B. Non-Fire Rated Door and Frame Units in Walls:
   1. Provide manufacturer's standard flush panel/door and frame.

C. Fire Rated Door and Frame Units in Walls:
   1. For fire rated units, provide manufacturer's standard insulated flush panel/doors, with continuous piano hinge and self-closing mechanism.

D. Locking Devices: Furnish flush, screwdriver-operated cam locks of number required to hold door in flush, smooth plane when closed.

E. Finishes:
   1. Attic hatch: Phosphate dipped with factory applied primer coat.
   2. Exterior: 3-coat 70% resin “Kynar 500” finish (i.e.: 7-mil prime coat, 9-mil color coat, and 9-mil clear top coat) with minimum 2.4 mil total dry film thickness, in color to match adjacent finish where occurs, unless otherwise selected by Architect from manufacturer's standard non-metallic colors - 15 colors minimum to select from, including white.
   3. Interior, Exposed to Normal View: To match finish on interior. Door "Finish Hardware" (refer to Section 08 7100), or if not indicated, to match existing hardware in room where occurs.
   4. Interior, in Service Areas, Above Ceilings, etc: Factory primed baked enamel.
   5. Toilet Rooms, Janitors Rooms, Kitchens, Kitchen Areas, Rooms Where Food is Stored, Prepared, Cooked and/or Served, and Break Rooms: Stainless steel, No. 4, satin finish.

2.05 FABRICATION

A. Weld, fill, and grind joints to ensure flush and square unit.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings in relation to adjacent finish surfaces. Secure rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

D. Coordinate installation with work of other trades.

E. Prepare perimeter of rough openings in concrete, CMU, and clay masonry with mortar/grout full-depth of wall and to size required; use pressure-treated wood as necessary for other concealed blocking, grounds, and supports at any stud wall construction.

3.03 ADJUST AND CLEAN

A. Adjust hardware and panels after installation for proper operation.

B. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Interior storefront.

C. Infill panels of metal and glass.

D. Aluminum doors and frames.

E. Weatherstripping.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: General requirements for mock-ups.

B. Section 05 5000 - Metal Fabrications: Steel attachment devices.

C. Section 08 1416 - Flush Wood Doors

D. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.

E. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2025.

B. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2024.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2026.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

E. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

F. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

G. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

H. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, and internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

D. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

E. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

F. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of professional structural engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with minimum 3 years of documented experience.

1.07 MOCK-UP

A. Construct a representative wall sample, 6 feet wide by 10 feet high, which includes face brick, mortar and accessories, architectural masonry veneer, cast stone, metal-framed storefronts, with masonry back-up and metal stud and sheathing backup where applicable; with accompanying flashing, sealants, and waterproofing (air barrier). Also, eave condition, including soffit and gutter is included. This panel will be for the purpose of approving the wall system and its components.

B. Locate where directed, or indicated.

C. Coordinate with work of other Sections.

D. Approved mock-up will become standard for appearance and workmanship.

E. Mock-up may not remain as part of the completed work.

F. Mock-up shall be used for testing of exterior storefront.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.09 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers:
   1. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Rabbet: For 1 inch (25 mm) insulating glazing for exterior applications. As indicated for interior applications.
   2. Glazing Position:
      a. Exterior: Outside glazed, front plane.
      b. Interior: Outside glazed, center plane, unless indicated otherwise.
   3. Water Leakage Test Pressure Differential: 12 lbf/sq ft (575 Pa).
   4. Air Infiltration Test Pressure Differential: 6.24 psf (300 Pa).
   5. Finish for exterior storefront: Class I color anodized.
   6. Finish for interior storefront: High performance organic coating.
   7. Finish Color: As selected by Architect from manufacturer's standard line.
   8. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   9. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   10. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   11. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   12. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
   13. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Performance Requirements
   1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
      a. Design Wind Loads: Comply with requirements of ASCE 7.
      b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
   2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf (390 Pa).
   3. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf (75 Pa) pressure difference.
   4. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.

5. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min/sq ft (0.3 L/s/sq m) of wall area, measured at specified differential pressure across assembly in accordance with ASTM E283.
6. Water Leakage: None, when measured in accordance with ASTM E331 at specified pressure differential.
7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

2.03 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
   1. Framing members for interior applications need not be thermally broken.
   2. Glazing Stops: Flush.
   3. Cross-Section: 2 x 4-1/2 inch nominal dimension, for interior and exterior applications.

B. Swing Doors: Glazed aluminum.
   1. Thickness: 1-3/4 inches (43 mm).
   2. Top Rail: 3-1/2 inches (____ mm) wide.
   3. Vertical Stiles: 3-1/2 inches (____ mm) wide.
   4. Bottom Rail: 10 inches (254 mm) wide.
   5. Glazing: Single glazed.
   6. Glazing Stops: Square.
   7. Finish: Same as storefront.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.

C. Glass: As specified in Section 08 8000.

D. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

E. Glazing Accessories: See Section 08 8000.

2.05 FINISHES

A. Superior Performing Organic Coatings: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride (PVDF) system.

B. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system.

C. Color: As selected by Architect from manufacturer's standard range.

2.06 HARDWARE

A. Door Hardware: Storefront manufacturer's standard type to suit application.
   1. Include for each door: continuous hinge and weatherstripping.

B. Other Door Hardware: See Section 08 7100.

2.07 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

E. Arrange fasteners and attachments to conceal from view.

F. Reinforce components internally for door hardware.

G. Increase gauge or reinforce framing members as required for imposed loads and span conditions.

H. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
   1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Install hardware using templates provided.

J. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 08 8000.

K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm per m) non-cumulative or 0.06 inch per 10 feet (1.5 mm per 3 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

B. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.
   1. Perform a minimum of two tests in each designated area as indicated on drawings.
   2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

C. Provide field testing of installed storefront system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.
   1. Perform a minimum of two tests in each designated area as indicated on drawings.
   2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
   3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf (200 Pa).
      a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce (14 gram) that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.

D. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 5413
FIBERGLASS CLAD WOOD WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fixed fiberglass clad wood windows.

B. Factory glazed.

C. Perimeter sealant.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 07 9005 - Joint Sealers: Perimeter sealant and back-up materials.

1.03 REFERENCE STANDARDS

A. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

B. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

C. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2000 (Reapproved 2008)

D. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact; 2007.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, anchorage and fasteners, glass, internal drainage details.

C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, installation requirements.

D. Samples: Submit two corner sash sections, 8x8 inch (____x____ mm) in size, illustrating window frame section.

E. Submit two samples of operating hardware.

F. Manufacturer's Certificate: Certify that products of this section meet or exceed specified requirements.

G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.

1.07 MOCK-UP

A. Include Fiberglass Windows in Mock-Up as described in Section 01 4000 - Quality Requirements, and on drawings.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.

B. Jig, brace, and box the window frame assemblies for transport to minimize flexing of members or joints.

1.09 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).

B. Maintain this minimum temperature during and after installation of sealants.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a ten year period after Date of Substantial Completion.

C. Provide twenty year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same.

D. Provide manufacturer's 10 year warranty for window assembly and components, including degradation of color finish.

E. Provide manufacturer's 20 year warranty against stress cracks in glass.

F. Provide manufacturer's 10 year warranty covering hardware and other non-glass components from manufacturing defects.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fiberglass-Clad Wood Windows:
   1. Marvin; ; [Basis of Design]: www.marvin.com.
   2. Substitutions: See Section 01600 - Product Requirements.

2.02 WINDOW UNITS

A. Fiberglass-Clad Wood Windows:
   1. Fiberglass: Pultruded, reinforced fiberglass.
   2. Wood veneer: Clear pine veneer. 0.020 inches thick nominal, with manufacturer's recommended backing. Water repellent preservative treated.
   3. Performance Requirements: ANSI/AAMA/101/I.S.2.
   4. Configuration: Direct set, unless indicated otherwise.

B. Performance Requirements:
   1. Forced Entry Resistance: Conform to ASTM F588 requirements for performance level 10 for window type A.
   2. System Design: Design and size components to withstand dead and live loads caused by pressure and suction of wind acting normal to plane of window.
      a. Calculate design pressures in accordance with applicable code
      b. Measure performance of units by testing in accordance with ASTM E330/E330M, using test pressure equal to 1.5 times the design wind pressure and 10 second duration of maximum load.
   3. Deflection: Limit member deflection to 1/200 of the longer dimension with full recovery of glazing materials.
   4. Assembly: To accommodate, without damage to components or deterioration of seals, movement between window and perimeter framing, deflection of lintel.
   5. Air Infiltration: Limit air infiltration through assembly to 0.3 cu ft/min/sq ft (____ L/s/sq m) or less, of frame single-hung, measured at a reference differential pressure across assembly of 1.57 psf (75 Pa) as measured in accordance with _____.
   6. Vapor Seal: No vapor seal failure at interior static pressure of 1 inch (25 mm), 72 degrees F (22 degrees C), and 40 percent relative humidity.

7. Water Leakage: None, when measured in accordance with ASTM E331 at 6.0 psf.
8. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.
9. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound. Position thermal insulation on exterior surface of air barrier and vapor retarder.
10. Thermal Movement: Design sections to permit movement caused by thermal expansion and contraction of fiberglass to suit glass, infill, and perimeter opening construction.

2.03 COMPONENTS

A. Frames: Pultruded reinforced fiberglass 0.070 (nominal) inch wall thickness.
   1. Type: Nailing flange (for new windows)
   2. Frame Corners: Joined per manufacturer's standard.
   3. Frame depth:
      a. Fiberglass-Clad Wood: 4-9/16".
   4. Jamb Depth: 2".

B. Sills: Pultruded fiberglass: 10-degree (nominal) sloped for positive wash.

C. Sash: Pultruded fiberglass, 15/16-inch thickness.
   1. Provide custodial locks (for use by authorized personnel) for operable windows.

D. Fasteners: Stainless steel.

2.04 GLASS AND GLAZING MATERIALS

A. Select quality complying with ASTM C 1036. Insulating glass SIGMA/IGCC when tested in accordance with ASTM E 2190. STC/OITC ratings are tested to the stated performance level in accordance with ASTM E 90-09.

B. Glass and Glazing Materials:
   1. Glass in Exterior Lights: High Performance LowE.
      a. Comply with Alabama Energy Code
   2. U-value = 0.65. SHGC = 0.25

2.05 SEALANT MATERIALS

A. Perimeter Sealant and Backing Materials: Type as specified in Section 07 9005.

B. Glazing Sealant: Silicone bedding at exterior.
   1. Interior with glazing boot.

C. Sealant Used Within System (Not Used for Glazing): Type recommended by manufacturer.

2.06 FABRICATION

A. Fabricate framing, mullions and sash members with fusion welded corners and joints, in a rigid jig. Supplement frame sections with internal reinforcement where required for structural rigidity.

B. Form sills in one piece. Slope sills for wash.

C. Form snap-in glass stops, closure molds, weather stops, and flashings for tight fit into window frame section.

D. Form weather stop flange to perimeter of unit.

E. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

F. Arrange fasteners to be concealed from view.

G. Permit internal drainage weep holes and channels to migrate moisture to exterior. Provide internal drainage of glazing spaces to exterior through weep holes.

H. Double weatherstrip operable units.

I. Factory glaze window units.

2.07 FINISHES

A. Factory baked-on acrylic organic coating system. Meet AAMA 624-10 requirements.

B. Color:
   1. Exterior: As selected by Architect from minimum of 6 of manufacturer's colors.
   2. Interior of Fiberglass Clad Wood Windows: Treated bare wood.
      a. Unfinished stain grade with no exposed fasteners, holes, or fingerjoints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.

3.02 INSTALLATION

A. Install window units in accordance with manufacturers instructions.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

D. Install sill.

E. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

F. Coordinate attachment and seal of perimeter air and vapor barrier materials.

G. Install perimeter sealant and backing materials in accordance with Section 07 9005.

3.03 TOLERANCES

A. Maximum Variation from Level or Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 0.5 inches per 100 ft (12 mm/30 m), whichever is less.

3.04 FIELD QUALITY CONTROL

A. Test installed windows by an approved testing agency approved and paid for by the Owner for compliance with specified performance requirements for water penetration, in accordance with AAMA 502-08 Field Testing using uniform pressure and same pressure difference as specified for laboratory tests.
   1. [VERIFY MFRS AIR & WATER PERFORMANCE FOR APPROPRIATE WINDOW TYPE.]
   2. Architect and Owner shall select three (3) windows of the first 25 installed windows for Field verification of performance.
   3. If any window fails, test two (2) additional windows of Architect's choosing at Contractor's expense.

B. Repair or replace windows that have failed field testing and retest until performance is satisfactory. Any repairs made to installed windows to demonstrate compliance with performance shall also be made to all other windows.

3.05 ADJUSTING

A. Adjust hardware for smooth operation and secure weathertight closure.

3.06 CLEANING

A. Remove protective material from pre-finished surfaces.

B. Wash surfaces by method recommended and acceptable to sealant and window manufacturer; rinse and wipe surfaces clean.

C. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

3.07 PROTECTION

A. Protect windows from damage until Substantial Completion.

B. Replace damaged windows that cannot be repaired to Architect's satisfaction.

3.08 CLOSE OUT DOCUMENTS

A. Provide manufacturer's maintenance manual as an electronic file.

B. Conduct scheduled walk-thru with Owner's representative to discuss routine service and maintenance.

END OF SECTION

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SECTION 08 8000
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glass.

C. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.

B. Section 08 4313 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.

C. Section 10 2800 - Toilet, Bath, and Laundry Accessories: Mirrors.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

D. ASTM C1036 - Standard Specification for Flat Glass; 2025.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.

F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2024, with Editorial Revision (2025).

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.

H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.

I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2024.

J. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.

K. GANA (GM) - GANA Glazing Manual; 2022.

L. GANA (SM) - GANA Sealant Manual; 2008.

M. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Provide compatibility testing of IGU edge seal with glazing compounds and setting blocks, and submit results of testing.

E. Samples: Submit two samples 12 by 12 inch (___ by ___ mm) in size of glass and plastic units, showing coloration and design.

F. Certificate: Certify that products of this section meet or exceed specified requirements.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Insulating Glass Units: One of each glass size and each glass type.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods.

B. Labeling: Furnish each pane of fire resistance-rated glazing and each pane of safety glazing with a permanent identification which meets the requirements of the latest approved edition of the International Building Code.

C. Glazing Standards: Comply with recommendations of Glass Association of North America (GANA) "Glazing Manual" and "Sealant Manual", and SIGMA TM-3000, "Vertical Glazing Guidelines", except where more stringent requirements are indicated. Refer to those publications for definitions of glass and glazing terms not otherwise defined in this section or other referenced standards.

D. Safety Glazing Standard: Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category II materials.

E. Fire Resistance Rated Glass: Provide glass products that meet CPSC 16 CFR 1201, Category II requirements for fire-rated glass and are labeled and listed by UL or other testing and inspecting agency acceptable to authorities having jurisdiction.

F. Insulating Glass Certification Program: Provide insulating glass units permanently marked either on spacers or at least one component pane of units with appropriate certification label of the inspecting and testing organization indicated below.
   1. Insulating Glass Certification Council (IGCC).
      a. ASTM E 2190.

G. Installer Qualifications: Company specializing in performing work of type specified, with minimum 3 years of documented experience.

1.07 MOCK-UPS

A. Include Glazing in Mock-Up as described in Section 01 4000 - Quality Requirements.

1.08 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Sealed Insulating Glass Units: Provide a ten (10) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

C. Replacements Under Warranties: Provide same warranty as original glass and glazing, beginning from date of replacement completion for glass units replaced under Warranty provisions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:
   1. Guardian Glass, LLC: www.guardianglass.com/#sle.

2. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.

2.02 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
   2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
   3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
   4. Tinted Type: ASTM C1036, Class 2 - Tinted, with color and performance characteristics as indicated.
   5. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

B. Fire-Protection-Rated Glazing: Type, thickness, and configuration as required to achieve indicated ratings.
   1. IBC Fire Protection Rating: As indicated on drawings.
   2. Provide products listed by Underwriters Laboratories or Intertek Warnock Hersey.
   3. Labeling: Provide permanent label on each piece giving the IBC rating and other information required by the applicable code.

C. Fire-Protection-Rated Glazing:
   1. IBC Fire Protection Rating: D-H-T-90 or W-90, minimum.

D. High Impact-Resistant Tempered Safety Glazing: Complying with 16 CFR 1201 test requirements for Category II.

E. Glass-Ceramic Safety Glazing: UL- or WH-listed as fire-protection-rated glazing and complying with 16 CFR 1201 test requirements for Category II without the use of a surface-applied film.

F. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3, and complying with other requirements specified.

G. Mirror Glass : ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality Q1 (mirror select); silvering, protective coating and physical characteristics complying with ASTM C1503; 6 mm minimum thick.
   1. Sizes noted on Drawings.

H. One-Way Mirror Glass: Mirror quality float glass (Q2) with factory coating. Tempered where indicated, or required.

2.03 INSULATING GLASS UNITS

A. Manufacturers:
   1. Glass: Any of the manufacturers specified for float glass.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Metal-Edge Spacers: Aluminum, bent and soldered corners.
   3. Spacer Color: As selected by Architect.
   4. Edge Seal: Primary seal - Polyisobutylene. Secondary seal - Silicone.
   5. Purge interpane space with dry air, hermetically sealed.

C. Type IG-1 - Sealed Insulating Glass Units: Vision glass, low-E.
   1. Applications: Exterior glazing unless otherwise indicated.
   2. Space between lites filled with air.
   3. Outboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick, minimum.
      a. Tint: As Selected.
      b. Coating: Low-E (passive type), on #2 surface.
   4. Inboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick, minimum.
      a. Tint: Clear.
   5. Edge Spacer: See "Sealed Insulating Glass Units" Article below.

6. Edge Spacer Color: See "Sealed Insulating Glass Units" Article below.
7. Total Thickness: 1 inch (25.4 mm).
8. Glazing Method: Gasket Glazing.

D. Type IG-2 - Sealed Insulating Glass Units: Spandrel glazing.
1. Applications: Exterior spandrel glazing unless otherwise indicated.
2. Outboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick, minimum.
   a. Tint: Clear.
   b. Coating: Same as on vision units, on #2 surface.
3. Inboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick.
   a. Tint: Clear.
   b. Opacifier: Ceramic frit, on #4 surface.
   c. Opacifier Color: As selected by Architect.
4. Total Thickness: 1 inch (25.4 mm).
5. Glazing Method: Gasket glazing.

E. Type IG-3 - Insulating Glass Units: Safety glazing.
1. Applications:
   a. Glazed sidelights and panels next to doors.
   b. Other locations required by applicable federal, state, and local codes and regulations.
   c. Other locations indicated on drawings.
2. Type: Same as other vision glazing except use fully tempered float glass for both outboard and inboard lites.
3. Edge Spacer: See "Sealed Insulating Glass Units" Article below.
4. Edge Spacer Color: See "Sealed Insulating Glass Units" Article below.

F. Type IG-4 - Sealed Insulating Glass Units: Spandrel Safety glazing:
1. Applications: Provide this type of glazing in the following locations, if spandrel glazing is indicated for these locations:
   a. Glazed lites in exterior doors.
   b. Glazed sidelights and panels next to doors.
   c. Other locations required by applicable federal, state, and local codes and regulations.
   d. Other locations indicated on the drawings.
2. Type: Same as other spandrel glazing except use fully tempered float glass for both outboard and inboard lites.
3. Tint and opacifier: As scheduled for other spandrel glazing.

G. Type E-1 - Single Exterior Vision Glazing:
1. Application: Exterior glazing not indicated to be Insulating Glass Units.
2. Type: Annealed float glass.
3. Tint: Tinted to match other exterior vision glazing.
4. Thickness: 1/4 inch (6 mm).
5. Glazing Method: Gasket glazing.

H. Type E-2 - Single Exterior Vision Glazing: Safety glazing.
1. Applications: Exterior glazing not indicated to be Insulating Glass Units, but required to be safety glazed.
   a. Glazed lites in exterior doors.
   b. Other locations required by applicable federal, state, and local codes and regulations.
2. Type: Fully tempered float glass.
3. Tint: Tinted to match other exterior vision glazing.
4. Thickness: 1/4 inch (6 mm).
5. Glazing Method: Gasket glazing.

I. Type S-1 - Single Vision Glazing:
1. Application: All interior glazing unless otherwise indicated.
2. Type: Annealed float glass.

3. Tint: Clear.
4. Thickness: 1/4 inch (6 mm).
5. Glazing Method: Gasket glazing.

J. Type S-2 - Fire-Protection-Rated Glazing:
1. IBC Fire Protection Rating: D-H-T-90, minimum.
2. Safety Certification: 16 CFR 1201 Category II.
3. Application: Provide this type of glazing in the following locations:
a. Glazed lites in fire doors.
b. Fire windows.
c. Sidelights, borrow lites, and other glazed openings in partitions indicated as having an hourly fire rating.
d. Other locations indicated on the drawings.
4. Fire Rating: As indicated on the drawings.
5. Type: Glass-ceramic safety glazing.
6. Thickness: 1/4 inch (6 mm).
7. Glazing Method: As required for fire rating.

K. Type S-3 - Single Safety Glazing: Non-fire-rated.
1. Application: Provide this type of glazing in the following locations:
a. Glazed lites in doors, except fire doors.
b. Glazed sidelights to doors, except in fire-rated walls and partitions.
c. Other locations required by applicable federal, state, and local codes and regulations.
d. Other locations indicated on the drawings.
2. Type: Fully tempered float glass as specified.
3. Tint: Clear.
4. Thickness: 1/4 inch (6 mm).
5. Glazing Method: Gasket glazing.

L. Type S-4 - Single Laminated Glazing.
1. Application: Pass Thru Windows
2. Type: Laminated.
3. Tint: Clear.
4. Thickness: 1/2 inch (12 mm).

M. Mirror Glass: Where indicated.

N. One-Way Mirror: Where indicated.

2.04 GLAZING COMPOUNDS

A. Type GC-2 - Butyl Sealant: Single component; ASTM C920 Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

B. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; _____ color.

C. Manufacturers:
1. Bostik Inc: www.bostik-us.com/#sle.
2. Momentive Performance Materials, Inc: www.momentive.com/#sle.
3. Pecora Corporation: www.pecora.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

D. Glazing Putty: Polymer modified latex recommended by manufacturer for outdoor use, knife grade consistency; grey color.

E. Butyl Sealant: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

F. Acrylic Sealant: Single component, solvent curing, non-bleeding; ASTM C920, Type S, Grade NS, Class 12-1/2, Uses M and A; with cured Shore A hardness range of 15 to 25; color as selected.

G. Polysulfide Sealant: Two component; chemical curing, non-sagging type; ASTM C920, Type M, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

H. Polyurethane Sealant: Single component, chemical curing, non-staining, non-bleeding; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 20 to 35; color as selected.

I. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.05 ACCESSORIES

A. Setting Blocks: Neoprene, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch (75 mm) long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

D. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.

E. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option I; color as selected.

F. Glazing Clips: Manufacturer's standard type.

G. Speak Thru Intercom: Aluminum outside and inside face, 5-inch diameter, SST5 Brushed Stainless Steel finish.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.04 INSTALLATION - DRY GLAZING METHOD (TAPE AND GASKET SPLINE GLAZING)

A. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.

E. Carefully trim protruding tape with knife.

3.05 INSTALLATION - DRY GLAZING METHOD (TAPE AND TAPE)

A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

D. Place glazing tape on free perimeter of glazing in same manner described above.

E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

F. Carefully trim protruding tape with knife.

3.06 INSTALLATION - WET GLAZING METHOD (COMPOUND AND COMPOUND)

A. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch (610 mm) centers, kept 1/4 inch (6 mm) below sight line.

B. Locate and secure glazing pane using glazers' clips.

C. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.07 INSTALLATION - WET/DRY GLAZING METHOD (PREFORMED TAPE AND SEALANT)

A. Cut glazing tape to length and set against permanent stops, 3/16 inch (5 mm) below sight line. Seal corners by butting tape and dabbing with butyl sealant.

B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.

E. Install removable stops, with spacer strips inserted between glazing and applied stops 1/4 inch (6.4 mm) below sight lines.
   1. Place glazing tape on glazing pane of unit with tape flush with sight line.

F. Fill gap between glazing and stop with appropriate type sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch (9 mm) below sight line.

G. Apply cap bead of appropriate type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.08 INSTALLATION - WET/DRY GLAZING METHOD (TAPE AND SEALANT)

A. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.

D. Install removable stops, spacer shims inserted between glazing and applied stops at 24 inch (610 mm) intervals, 1/4 inch (6 mm) below sight line.

E. Fill gaps between pane and applied stop with appropriate type sealant to depth equal to bite on glazing, to uniform and level line.

F. Carefully trim protruding tape with knife.

3.09 INSTALLATION - BUTT JOINT GLAZING METHOD (SEALANT ONLY)

A. Temporarily brace glass in position for duration of glazing process; mask edges of glass at adjoining glass edges and between glass edges and framing members.

B. Temporarily secure a small diameter nonadhering foamed rod on back side of joint.

C. Apply sealant to open side of joint in continuous operation; thoroughly fill joint without displacing foam rod, and then tool sealant surface smooth to concave profile.

D. Permit sealant to cure then remove foam backer rod, and then apply sealant to opposite side, tool smooth to concave profile.

E. Remove masking tape.

3.10 INSTALLATION - MIRRORS

A. Install mirrors in accordance with GANA recommendations.

B. Install mirrors in correctly sized openings, using setting blocks (neoprene 80 to 90 Shore A durometer hardness), spacer shims, stainless steel clips, and adhesive compatible with mirror coating and wall substrate.

C. Set mirrors plumb and level, free of optical distortion.

D. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

3.11 FIELD QUALITY CONTROL

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.12 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

3.13 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

END OF SECTION

SECTION 08 9100
LOUVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvers, frames, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 6200 - Sheet Metal Flashing and Trim.

B. Section 07 9005 - Joint Sealers.

C. Division 23 - Mechanical Sections.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.

C. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2021, with Editorial Revision (2022).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.

D. Samples: Submit two samples 2 by 2 inches (50 by 50 mm) in size illustrating finish and color of exterior and interior surfaces.

E. Test Reports: Independent agency reports showing compliance with specified performance criteria.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.

1. Finish: Include twenty year coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.01 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.

1. Wind Load Resistance: Design to resist positive and negative wind load of 25 psf (of 1.2 kPa) without damage or permanent deformation.
2. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft (3.1 g/sq m) water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.

3. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
4. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.

B. Stationary Louvers: Horizontal blade, extruded aluminum construction, with concealed intermediate mullions.
1. Free Area: 57 percent, minimum.
2. Blades: Drainable.
3. Frame: Depth as indicated on drawings, channel profile; corner joints mitered and, with continuous recessed caulking channel each side and extended subsill.
4. Aluminum Thickness: Frame 12 gauge, 0.0808 inch (2.05 mm) minimum; blades 12 gauge, 0.0808 inch (2.05 mm) minimum.
5. Aluminum Finish: Class I natural anodized; finish welded units after fabrication.

2.02 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

2.03 FINISHES

A. Superior Performing Organic Coatings: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system.
1. Polyvinylidene fluoride (PVDF) multi-coat thermoplastic fluoropolymer coating system, including minimum 70 percent PVDF color topcoat and minimum total dry film thickness of 0.9 mil (0.023 mm); color and gloss as selected from manufacturer's full line, if not indicated on drawings.

B. Primer: Zinc chromate, alkyd type.

2.04 ACCESSORIES

A. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.

B. Bird Screen: Interwoven wire mesh of steel, 14 gauge, 0.0641 inch (1.63 mm) diameter wire, 1/2 inch (13 mm) open weave, diagonal design.

C. Insect Screen: 18 x 16 size aluminum mesh.

D. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.

E. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

F. Sealant: Type, as specified in Section 07 9005.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.

B. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

D. Secure louver frames in openings with concealed fasteners.

E. Install perimeter sealant and backing rod in accordance with Section 07 9005.

F. Coordinate with installation of mechanical ductwork.

3.03 CLEANING

A. Strip protective finish coverings.

B. Clean surfaces and components.

END OF SECTION

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SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud wall framing.
B. Metal channel ceiling framing.
C. Fire rated area separation walls.
D. Fiber reinforced backing board.
E. Gypsum wallboard.
F. Moisture-Resistant board.
G. Glass mat faced gypsum board sheathing.
H. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Structural steel stud framing.
B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
C. Section 07 1400 - Fluid-Applied Waterproofing: Water-resistive barrier and air barrier over sheathing. Sealant for sheathing on which fluid-applied waterproofing will be applied.
D. Section 07 2100 - Thermal Insulation: Acoustic insulation.
E. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.

1.03 REFERENCE STANDARDS

A. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data; 2017.
B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
C. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).
D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2025.
F. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).
G. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
H. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2026).
I. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
J. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2025.
K. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.
L. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.
M. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

N. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.

O. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2024.

P. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2025.

Q. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.

R. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

S. GA-600 - Fire Resistance and Sound Control Design Manual; 2024.

T. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data:

C. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

D. Test Reports: For stud framing products that do not comply with AISI S220 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.05 QUALITY ASSURANCE

A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.
   1. Maintain one copy of standards at project site.
   2. Where indicated, provide materials and construction which are identical with those of assemblies whose fire resistance rating has been determined per ASTM E 119 by a testing and inspecting organization acceptable to authorities having jurisdiction.

B. Single Source Responsibility: Comply with one of the following:
   1. Obtain all steel framing and all metal trim from a single manufacturer.
   2. Obtain each type of gypsum board and related joint treatment materials from a single manufacturer.
   3. Provide a confirmation letter from both the gypsum board manufacturer and the joint compound manufacturer that their products are compatible and warrantable if used together.

C. Construct a representative wall sample, 6 feet wide by 10 feet high, which includes face brick, mortar and accessories, architectural masonry veneer, cast stone, metal-framed storefronts, with masonry back-up and metal stud and sheathing backup where applicable; with accompanying flashing, sealants, and waterproofing (air barrier). Also, eave condition, including soffit and gutter is included. This panel will be for the purpose of approving the wall system and its components.

D. Pre-Construction Conference: Prior to beginning work associated with roof system, the Contractor and appropriate subcontractors shall meet to discuss coordination of the work of the trades associated with the installation of the roof system, suspended acoustical and gypsum board ceiling, suspended mechanical ductwork, suspended light fixtures, etc. This work shall be planned and coordinated to provide hanger attachments needed by the various trades in a manner that will minimize conflict with installation of the roof system.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire rated assemblies as indicated on drawings.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside, under cover, and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.

C. When materials are moved into the building, distribute pallets and loads evenly around work areas so as to avoid overloading structure, causing damage to any materials, interfering with work of other trades, etc.

D. Handle gypsum boards to prevent damage to edges, ends and surfaces. Do not bend or otherwise damage metal corner beads, trim, etc.

PART 2 PRODUCTS

2.01 METAL FRAMING MATERIALS

A. Material and Product Requirements: AISI S201 and AISI S220.

B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.

C. Manufacturers - Metal Framing, Connectors, and Accessories:
1. ClarkDietrich: www.clarkdietrich.com/#sle.
2. Dale/Incor: www.daleincor.com.
3. Falcon Metal and Supply Co.: www.falconms.com.
4. Marino: www.marinoware.com/#sle.
5. MBA Metal Framing: www.mbastuds.com.
6. United States Gypsum Company.

D. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (L/240 at 240 Pa). Install with flange edges bent back 90 deg. and doubled over to form 3/16-inch minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal and minimum depth as follows:
1. Metal studs at interior partitions shall be 3-5/8-inches x 20 gauge (362 S162-33), 6-inches x 20 gauge (600 S162-33), or 8-inches x 18 gauge (800 S162-43) at locations indicated on the Drawings, spaced at 16-inches o.c., unless otherwise indicated below or otherwise shown on drawings or required by project conditions. Stud width shall be 1-5/8-inches unless otherwise indicated.
2. Jamb studs shall be no less than 20 gauge.
   a. Studs shall be joined together at 4'-0" intervals.
3. Use double studs or 6-inch studs, as indicated or as otherwise required, for chase walls, piping, conduits, or etc.
4. Special stud tracks for curved walls shall be equivalent to "Flex-C Trac" galvanized flexible segmented track with slidable side straps, as manufactured by Flex-Ability Concepts, Inc.; Oklahoma City, OK.
5. Runners: U shaped, sized to match studs.
6. Ceiling Channels: C-shaped.
7. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
8. Resilient Furring Channels: 1/2 inch (12 mm) depth, for attachment to substrate through both legs; both legs expanded metal mesh.

E. Exterior Non-Loadbearing Studs and Furring for Application of Gypsum Board: As specified in Section 05 4000.

F. Loadbearing Studs for Application of Gypsum Board: As specified in Section 05 4000.
1. Studs: "C" shaped with flat or formed webs with knurled faces.
2. Any interior load-bearing studs shall be at least 6-inches depth x 18 gauge (600S162-43), or 8-inches x 18 gauge (800S162-43), unless otherwise indicated on Drawings –galvanized C-studs spaced at 16-inches o.c.

G. Shaft Wall Studs and Accessories: Galvanized sheet steel.

1. Metal studs at interior partitions shall be 3-5/8-inches x 20 gauge (362 S162-33), 6-inches x 20 gauge (600 S162-33), or 8-inches x 18 gauge (800 S162-43) at locations indicated on the Drawings, spaced at 16-inches o.c., unless otherwise indicated below or otherwise shown on drawings or required by project conditions. Stud width shall be 1-5/8-inches unless otherwise indicated.

H. Steel Framing Components for Suspended and Furred Ceilings:
   1. General: Provide components which comply with ASTM C 754 for materials and sizes, unless otherwise indicated.
   2. Wires for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
   3. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
   4. Steel Studs for Furring Channels: ASTM C 645, with flange edges bent back 90 deg. and doubled over to form 3/16-inch minimum lip (return), minimum thickness of base (uncoated) metal and minimum depth as follows:
      a. Thickness: 20 gauge, unless otherwise indicated.
      b. Depth: As indicated.
      c. Spacing: As indicated in referenced standard and on drawings, but no less than at all edges and 24-inches o.c.
   5. Steel Rigid Furring Channels: ASTM C645, hat-shaped, depth of 7/8-inch, and minimum thickness of base (uncoated) metal as follows:
      a. Thickness: 20 gauge at interior and 18 gauge at exterior, unless otherwise indicated.
      b. Spacing: As indicated in referenced standard and on drawings, but not less than at all edges and 16-inches o.c.
         1) At ceilings and soffits indicated to receive more than a single layer of gypsum board, spacing shall be not less than at all edges and 16-inches o.c.
   6. Grid Suspension System: ASTM C 645, manufacturer's standard grid suspension system composed of main beams and cross furring members which interlock to form a modular supporting network.
      a. Locations for Use: Provide grid type suspension systems for sloped and horizontal ceiling applications of interior gypsum board products which are not attached directly to primary framing system; Minimum 4-feet x 4-feet grid and cross tees at 2-feet o.c., with minimum installation requirements as required by manufacturer's current written instructions, referenced standards, and as indicated in this Section and Section 09511 - "Acoustical Panel Ceilings". Provide and comply with manufacturer's published requirements for accessories, trim and hanger wire, and as otherwise required to provide flat ceilings without deflection or sag.
      b. Product/Manufacturer: Provide suspended modular grid furring system equivalent to standard drywall suspension system for flat ceilings, with 1-1/2-inch grid faces, and as follows:
         1) Equivalent to "Drywall Suspension System", as manufactured by USG Interiors, or one of the other above named manufacturers.

I. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

J. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.
   1. Bottom Track: Unless otherwise indicated or required by project conditions, fire-ratings, etc., provide manufacturer's standard Deep Leg Tracks, unpunched unless otherwise indicated, of size, shape and gauge indicated, with 1-5/16-inch flange.
   2. Deflection Track: Typical at stud walls up to slab or similar fixed structure at top of walls: Provide for no less than 1" of vertical movement, equivalent to one of the following:
      a. Dietrich Double Track System
      b. Dietrich Track-Over-Track System
      c. Dietrich SLP-TRK slotted track system
      d. Dietrich TR-Series with Spazzer 9200 Bar (SPZD)

3. Special stud tracks for all curved walls shall be equivalent to "Flex-C Trac" galvanized flexible segmented track with slidable side straps, as manufactured by Flex-Ability Concepts, Inc.; Oklahoma City, OK.
4. Special stud tracks for all arched walls shall be equivalent to "Flex-C Arch" galvanized flexible segmented track with slidable straps, as manufactured by Flex-Ability Concepts, Inc.; Oklahoma City, OK.
5. Provide deflection track at exterior wall and floor-to-floor walls - typical.

K. Continuous Horizontal Bridging/bracing:
1. 1-1/2-inch cold-rolled channels (galvanized).
2. Spacing: 4'-0" or 4'-6" o.c. vertically, through pre-punched slots in studs.
3. Splice Plates: 16 gauge at all splices.
4. Anchors (bridging channels to studs): 1-1/2-inches x 2-inches x 16 gauge clip angle, 1/4-inch less than stud width, secured with four (4) 5/8-inch S-14 screws. (Anchors required at ends of runs, where snap-in fit to stud slots is not snug or allows stud to move/slide on channels, and at studs on each side of splices in bridging channels).

2.02 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
1. CertainTeed Corporation: www.certainteed.com/#sle.
2. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
3. National Gypsum Company: www.nationalgypsum.com/#sle.
4. USG Corporation: www.usg.com/#sle.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and horizontal surfaces, unless otherwise indicated.
2. Fire Resistant Type: Type X at all locations, unless other type is required by indicated tested assembly.
3. Thickness: 5/8 inch (16 mm).
4. Edges: Tapered.

C. Moisture and Mold-Resistant Paper-Faced Products:
1. Core Type: Type X.
2. Thickness: 5/8 inch (16 mm).
3. Edges: Tapered.
4. Application: At rooms with toilet fixtures and/or service sinks, entire wall behind sinks, and elsewhere as indicated or wherever water-resistant gypsum board is indicated.
5. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
6. Product:
   a. USG Sheetrock brand "Mold Tough" gypsum panels.
   b. Temple-Inland "ComfortGuard Mold Resistant Gypsum Board".
   c. Substitutions: See Section 01 6000 - Product Requirements.

D. Backing Board For Tile:
1. Fiber-Reinforced Gypsum Panels: As defined in ASTM C1278, mold-resistant, and with water-resistant core. No paper face.
2. Thickness: 5/8 inch.
3. Product:
   a. USG Fiberock brand "Aqua-Tough" Tile backerboard.
   b. Temple-Inland "GreenGlass Tile Backer".
   c. Substitutions: See Section 01 6000 - Product Requirements.
4. Application: Wall surfaces behind tile.

E. Gypsum Exterior Sheathing Board: Glass Mat gypsum sheathing board consisting of noncombustible gypsum core incorporating a water-resistant material, surfaced on face, back

and long edges with glass mats; complying with ASTM C 1177 and requirements indicated below:

1. Type: Type X at all locations. (Noncombustible.)
2. Edge and End Configuration: Square.
3. Thickness: 5/8-inch, unless indicated otherwise.
4. Size: 4'-0" x 8'-0" or 9'-0" as required for coordination with framing.
5. Products:
   a. Georgia Pacific "DensGlass Sheathing".
   b. CertainTeed Gypsum "GlasRoc Sheathing".
   c. Gold Bond "eXP Extended Exposure Sheathing".
   d. Lafarge North America "Weather Defense Platinum Type X".
   e. Temple-Inland "GreenGlass Exterior Sheathing".
   f. USG "Securock Exterior Sheathing".
6. Joints: Sealed and facing-taped joints. Polyurethane joint sealant reinforced with fiberglass mesh tape encapsulated in the sealant. Sheathing fastener heads shall be encapsulated with polyurethane sealant. Fiberglass reinforcement is not needed at sheathing fastener heads. NO acrylic latex sealant shall be used.
7. Extent: For Exterior sheathing, where plywood or other wood sheathing is not indicated.

2.03 GYPSUM BOARD ACCESSORIES

A. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

B. Finishing Accessories:
   1. Types: As detailed or required for finished appearance.
   2. Materials: 6063-T5 extruded aluminum alloy and G40 (Z120) galvanized steel sheet in accordance with ASTM A653/A653M.
   3. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

C. Extruded Moldings and Reveal Moldings: Provide manufacturer's standard alloy 6063-T5 extruded units with 70% resin 2-coat "Kynar 500" baked enamel finish, and as follows:
   1. Design: Provide shapes and configurations as indicated on the Drawings.
      a. Form reveal moldings to cover at least two sides and rear of reveal.
      b. At drywall (or plaster) edge, provide continuous expanded metal edge, designed for mudding-in.
      c. At ceiling grid edge, provide continuous edge designed for compatibility with lay-in ceiling grid.
   2. Color: To match ceiling grid in same room where occurs, unless indicated otherwise, and color as selected by Architect at any exterior locations.

D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners of glass-mat faced boards, and where recommended by manufacturer. Joint material shall be compatible with and approved by air barrier manufacturer, where applicable.
   2. Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners of paper faced boards, and where recommended by manufacturer.
   3. Ready-mixed vinyl-based joint compound.
   4. Chemical hardening type compound.

E. Vapor Barrier Joint Treatment: ASTM E2178 Vapor impermeable, self-adhered membrane.
   1. Semi-translucent air and vapor barrier, with acrylic pressure-sensitive adhesive
   2. Air Permeance: Less than 0.00005 cfm/sq ft at 75 Pa per ASTM E2178.
   3. Water Vapor Transmission: 0.26 US perm using Water Method per ASTM E96.
   4. For application in accordance with manufacturer's recommendations.
   5. Location: For Vapor Barrier at plenum ceiling, and where noted.

6. Manufacturer/Product:
   a. 3M Air and Vapor Barrier 3015: www.3M.com/industrial.
   b. Substitutions: See Section 01 6000 - Product Requirements.

F. Level 5 Surface System Options:
   1. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
   2. Factory-Applied Skim-Coated Drywall with matching Joint Compound: Rapid Deco Level 5 System by Lafarge.

G. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

H. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

I. Fasteners: Provide fasteners of type, material, size, corrosion resistance, holding power and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum drywall manufacturers for applications indicated.

J. Screws: ASTM C 1002; self-piercing tapping type; cadmium-plated for exterior locations.

K. Screws: ASTM C 954; steel drill screws for application of gypsum board to loadbearing steel studs.

L. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

M. Adhesive for Attachment to Wood, ASTM C557 and Metal:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.
   1. Environmental Requirements, General: Establish and maintain environmental conditions for application and finishing gypsum board to comply with ASTM C 840, with gypsum board manufacturer's recommendations, and with adhesive manufacturer's recommendations, for before, during, and after installation.
   2. Minimum Room Temperatures: For non-adhesive attachment of gypsum board to framing, maintain not less than 40º.
   3. Ventilate building spaces to remove water not required for drying joint treatment materials. Avoid drafts during dry, hot weather to prevent materials from drying too rapidly.

3.02 SEQUENCING AND SCHEDULING

A. Sequence installation of gypsum board and sheathing with installation of exterior cladding and roofing to comply with requirements indicated below:
   1. Do not leave gypsum sheathing board exposed to weather after its application for more than one month or, if protected as indicated below, for more than 6 months, unless otherwise warranted by manufacturer:
      a. Cover exterior surface of sheathing with a temporary air infiltration barrier equivalent to 6-mil polyethylene film. Apply covering immediately after sheathing is installed.
      b. Remove covering just prior to installation of asphalt felt, face brick, and similarly applied exterior materials.

3.03 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
   1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches (600 mm) on center.

2. Install studs at spacing required to meet performance requirements.

B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.
   1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
   2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.04 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Do not bridge building expansion and control joints with steel framing or furring members; independently frame both sides of joints with framing or furring members or as indicated.

C. Suspended Ceilings and Soffits: Space framing and furring members at 16 inches on center (at 400 mm on center).
   1. Level ceiling system to a tolerance of 1/1200.
   2. Laterally brace entire suspension system.
   3. Suspend ceiling hangers from building structural members and as follows:
      a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
      b. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapeze or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
      c. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
      d. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
      e. Secure hangers to structural support by connecting directly to structure where possible; otherwise, connect to anchorage devices or fasteners as indicated or required.
      f. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
      g. Do not attach hangers to steel deck tabs.
      h. Do not attach hangers to steel roof deck. Attach hangers to structural members.
      i. Do not connect or suspend steel framing from ducts, pipes or conduit.
      j. Keep hangers and braces 2-inches clear of ducts, pipes and conduits.
      k. Sway-brace suspended steel framing with hangers used for support.
      l. Install suspended steel framing components in sizes and at spacing indicated but not less than that required by referenced steel framing installation standard.
         1) Wire Hangers: 0.1620-inch diameter (8 gauge), 4-feet on center. Install supplementary hangers as necessary at ceiling fixtures to provide a hanger at each corner of each fixture, diffuser, grille, and other ceiling-mounted equipment.
      m. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross furring members to each other and butt-cut to fit into wall track.
   4. Install bracing as required at exterior locations to resist wind uplift.

D. Studs: Space studs at 16 inches on center (at 406 mm on center).
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Installation Tolerances: Install each steel framing and furring member so that fastening surface does not vary more than 1/8-inch from plane of faces of adjacent framing.
   3. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   4. Extend non-bearing wall partition framing to 6 inches above adjacent ceiling heights, except where partitions are indicated to terminate at suspended ceilings.
      a. Provide studs up to tie to structure at 4'-0" o.c. minimum, from partitions terminating below ceilings.
   5. Install steel studs and furring in sizes and at spacings, indicated but not less than that required by referenced steel framing installation standard.
   6. Install steel studs so that flanges point in the same direction and gypsum boards can be installed in the direction opposite to that of the flange.
   7. Install horizontal steel bridging/bracing in all walls, and the additional strap bracing at curved walls as steel framing progresses. Install in compliance with stud manufacturer's recommendations, at spacing indicated.
      a. Galvanized steel strap bracing shall be provided continuous at top and bottom runner tracks and at bridging locations at all curved stud walls.
   8. Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement, at locations indicated below to comply with details shown on Drawings:
      a. Where edges of suspended ceilings abut building structure horizontally at ceiling perimeters or penetration of structural elements.
      b. Where partition and wall framing abuts overhead structure:
         1) Unless framing is specifically indicated to terminate below ceilings, all framing and gypsum board shall extend up to bottom of structure above.
   9. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
   10. Install runners (tracks) at floors, ceilings and structural walls and columns, where gypsum drywall stud system abuts other construction.

E. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
   1. Frame door openings to comply with details indicated, with GA-219 and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
      a. Extend vertical jamb studs (double studs-typical) through suspended ceilings and attach to underside of floor or roof structure above, unless otherwise indicated.
   2. Frame openings other than door openings to comply with details indicated, or if none indicated, in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.
   3. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors and doors over 32-inches wide. Apply spot grout at each jamb anchor clip just before inserting board into frame.

F. Standard Wall Furring: Install at concrete and masonry walls scheduled to receive gypsum board, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.
   1. Orientation: Horizontal.
   2. Spacing: At 16 inches on center (At 400 mm on center).

G. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated and to GA-600 requirements.

H. Blocking: Install wood blocking for support of:
1. Framed openings.
2. Wall-mounted cabinets.
3. Plumbing fixtures.
4. Toilet partitions.
5. Toilet accessories.
6. Wall-mounted door hardware.
7. Heavy trim.
8. Shelving.
9. Furnishings.
10. Equipment services.

3.05 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Install "sound batts" and insulation as the work progresses. Refer to Section 07 2100 for additional information and requirements.

C. Acoustic Sealant: Install in accordance with manufacturer's instructions.
1. Place two beads continuously on substrate before installation of perimeter framing members.
2. Place continuous bead at perimeter of each layer of gypsum board.
3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.06 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. General application and finishing of gypsum Board:
1. Cut boards as recommended by manufacturer.
2. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 24-inches in alternate courses of board.
3. Install ceiling boards across framing in the manner which minimizes the number of end-butt joints, and which avoids end joints in the central area of each ceiling. Stagger end joints at least 24- inches.
4. Install wall/partitions boards in manner which minimizes the number of end-butt joints or avoids them entirely where possible. At high walls, install boards horizontally with end joints staggered over studs.
5. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16-inch open space between boards. Do not force into place.
6. Locate either edge or end joints over supports, except in horizontal applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
7. Attach gypsum board to steel studs so that leading edge or end of each board is attached to open (unsupported) edge of stud flange first.
8. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.
a. Cover both faces of steel stud partition framing with gypsum board in concealed spaces (above ceilings, etc.), except inside double or chase walls which are required to be braced internally.

1) Except where concealed application is required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. area, and may be limited to not less than 75% of full coverage.
2) Fit gypsum board around ducts, pipes, and conduits.
3) Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4-to-1/2-inch-wide joints to install sealant.

b. Fire-stop around penetrations as required by Codes and authorities having jurisdiction. Refer to Section 07840 for additional information and requirements.

9. Where interior partitions are indicated to extend to the structure above, the drywall shall also extend to the structure with the same number of layers as required below the ceiling.
10. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4-inch to 1/2-inch space and trim edge with "U" bead edge trim. Seal joints with acoustical sealant.
11. Gypsum panels applied to walls shall be applied with the bottom edge spaced a minimum of 1/4-inch above the floor.
12. At all interior walls, seal construction at perimeters of partition, partition intersections, control and expansion joints, openings and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of edge trim, and close off sound-flanking paths around or through construction, including sealing of partitions above acoustical ceilings.
    a. Offset boxes and similar openings minimum of one stud space, and insulate behind openings.
    b. Openings cut into wall for boxes shall leave maximum gap of 1/4" around box.
    c. Seal around box completely with acoustical sealant, or gasket recommended by manufacturer for acoustic isolation.
13. Space fasteners in gypsum boards in accordance with referenced gypsum board application and finishing standard and manufacturer's recommendations.

C. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
    1. Install gypsum wallboard as follows:
        a. On ceilings apply gypsum board prior to wall/partition board application to the greatest extent possible.
        b. On partitions/walls apply gypsum board vertically (parallel to framing), unless otherwise indicated or required for fire or smoke resistive rated assemblies. Provide maximum length panels, to minimize end joints.
        c. On partitions/walls 8'-1" or less in height apply gypsum board horizontally (perpendicular to framing); use maximum length sheets possible to minimize end joints.
    2. Single-Layer Fastening Methods: Apply gypsum boards to supports as follows:
        a. Fasten with screws

D. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
    1. Install gypsum backing board for base layer and gypsum wallboard for face layer.
    2. On ceilings apply base layer(s) prior to base layer application on walls/partitions; apply face layers in same sequence. Offset joints between layers at least 10-inches. Apply base layers at right angles to supports unless otherwise indicated.
    3. On partitions/walls apply base layer(s) and face layers vertically (parallel to framing) with joints of base layers over supports and face layer joints offset at least one stud or furring member space from base layer joints.

4. Multi-Layer Fastening Methods:
   a. Apply base layer(s) of gypsum board and face layer to base layer(s) as follows:
   b. Fasten both base layer(s) and face layer separately to supports with screws.

E. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

F. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
   1. Fasteners spaced approximately 8-inches o.c. and set back 3/8-inch minimum from edges and ends of boards.
   2. Cut boards at penetrations, edges and other obstructions of the work; fit tight against abutting work, except provide 3/8-inch setback where non-loadbearing work abuts structural elements at head and jambs.
   3. Coordinate installation of sheathing with installation of flashing and joint sealers so that these combined materials are installed in the sequence and manner which prevents exterior moisture from passing through complete exterior wall assembly to the interior.
   4. Apply fasteners so that screw heads bear tightly against face of gypsum sheathing boards but do not cut into face paper.
   5. Do not bridge building expansion joints with gypsum sheathing; cut and space edges to match spacing of structural support elements.

G. Fiber-Reinforced Gypsum Panels: Install in strict accordance with manufacturer's instructions.

H. Glass Mat Faced Gypsum Board: Install in strict accordance with manufacturer's instructions.

I. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

J. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For nonrated assemblies, install as follows:
   1. Single-Layer Applications: Adhesive application.
   2. Double-Layer Application: Install base layer using screws. Install face layer using adhesive.

K. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board with sealant.

3.07 INSTALLATION OF TRIM AND ACCESSORIES

A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges to comply with manufacturer's recommendations.

B. Control Joints: Place control joints consistent with lines of building spaces and as indicated on drawings.
   1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
   2. At exterior soffits, not more than 30 feet (10 meters) apart in both directions.
   3. Install control joints at spacings and locations required by referenced gypsum board application and finish standard, and approved by the Architect for visual effect.

C. Corner Beads: Install at external corners, using longest practical lengths.

D. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.08 JOINT TREATMENT

A. General: Apply treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects and elsewhere as required to prepare work for decoration.

B. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.

1. Joint tape and joint compound shall be compatible with waterproofing subsequently applied.

C. Paper Faced Gypsum Board: Use paper joint tape, embed with ready-mixed vinyl-based joint compound and finish with ready-mixed vinyl-based joint compound.

D. Fiber Reinforced Gypsum and Cement Board: Use alkali-resistant glass fiber tape, recommended by manufacturer, embedded in latex-fortified mortar or latex-based Type 1 mastic over the joint. Use same material as specified for tile setting.

E. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
2. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

F. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
2. Taping, filling, and sanding are not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
3. Taping, filling, and sanding are not required at base layer of double-layer applications.

G. Prefill open joints and rounded or beveled edges, if any, using setting-type joint compound.

H. Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.

I. Finish interior gypsum wallboard by applying the following joint compounds in 3 coats (not including prefill of openings in base), and sand between coats and after last coat:
1. Embedding and First Coat: Ready-mix drying-type all-purpose or taping compound.
2. Fill (Second) Coat: Ready-mix drying-type all-purpose or topping compound.
3. Finish (Third) Coat: Ready-mix drying-type all-purpose or topping compound.

J. Water-Resistant Gypsum Board and Exterior Gypsum Board: Finish joints between water-resistant backing board with tape and setting-type joint compound to comply with gypsum board manufacturer's written recommendations and installation standards referenced in related sections.

K. Vapor Barrier Joint Treatment: Install air and vapor barrier membrane in accordance with manufacturer's recommendations. Use rubber roller to insure tight seal against wall and between overlapped edges.

L. Partial Finishing: Omit third coat and sanding on concealed drywall construction which is indicated for drywall finishing, except where finishing is required to achieve fire-resistance rating, sound rating or to act as air or smoke barrier.

M. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
1. Option: Rapid Deco Level 5 System by Lafarge North America.

3.09 CLEANING AND PROTECTION OF WORK

A. Promptly remove any joint compound and adhesives and similar residue from adjacent surfaces, as it may occur.

B. Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum drywall construction remain without damage or deterioration at time of Substantial Completion.

3.10 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

3.11 FINISH LEVEL SCHEDULE

A. Level 1: Above finished ceilings concealed from view.

B. Level 2: Utility areas and areas behind cabinetry.

C. Level 3: Walls scheduled to receive textured wall finish.

D. Level 4: Walls and ceilings scheduled to receive flat or eggshell paint finish.

E. Level 5: Walls and ceilings scheduled to receive semi-gloss or gloss paint finish.

END OF SECTION

SECTION 09 3000
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Coated glass mat backer board as tile substrate.

D. Stone thresholds.

E. Ceramic trim.

F. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2024.

B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.

C. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2020.

D. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs; 2020.

E. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2024.

F. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.

G. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2025-2026.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches (457 by 457 mm) in size illustrating pattern, color variations, and grout joint size variations.

E. Certificate: Certify products of this section meet or exceed specified requirements.

F. Installer's qualification statement.

G. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Tile: 2 percent of each size, color, and surface finish combination, but not less than 10 square feet of each type.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

B. Installer Qualifications:
1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

PART 2 PRODUCTS

2.01 TILE

A. Porcelain Tile: Floor & Wall
1. Size: As indicated on drawings.
2. Color: As indicated on drawings.
3. Pattern: As indicated on drawings.
4. Products:

B. Natural Stone Tile:
1. Size: Random Mosaic
2. Edges: Square.
3. Products: See Finish Legend.

2.02 TRIM AND ACCESSORIES

A. Porcelain Trim: Matching bullnose ceramic shapes in sizes coordinated with field tile.
1. Applications:
a. Open Edges: Bullnose.
b. Inside Corners: Jointed.
c. Floor to Wall Joints: Cove base, unless indicated otherwise.
2. Manufacturers: Same as for tile.

B. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, set with tile mortar or adhesive.
1. Applications:
a. Open edges of reception desk tile.
b. Inside and outside wall corners.
c. Transition between floor finishes of different heights.
d. Thresholds at door openings.
e. Floor and wall expansion and control joints.
f. Floor-to-wall joints.
g. Borders and other trim as indicated on drawings.
2. Products:
a. Schluter-Systems; Designbase SL: www.schluter.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ADHESIVE MATERIALS

A. Manufacturers:
1. Bostik Inc: www.bostik-us.com.

2. Mapei Corporation: www.mapei.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Epoxy Adhesive: ANSI A118.3, thinset bond type.

C. Manufacturers:
1. Bostik, Inc: www.bostik-us.com.
2. Mapei Corporation: www.mapei.com.

D. Mortar Bed Materials: Portland cement, sand, latex additive, and water.

2.04 GROUTS

A. Grout: 100% solids epoxy grout as specified in ANSI A118.3 - 2005.
1. Colors: To be selected by Architect from manufacturer's full range.
2. Location: Floors in toilets, and elsewhere indicated.

2.05 THICK-BED MATERIALS

A. Mortar Bed Materials: Portland cement, sand, latex additive, and water.

2.06 ACCESSORY MATERIALS

A. Cleavage Membrane: No. 15 (6.9 kg) asphalt saturated felt.

B. Waterproofing Membrane: Equivalent to "ECB Anti-Fracture Membrane", as manufactured by NAC Products, Inc.; Cuyahoga Falls, Ohio (Phone: 1-800-633-4622).
1. Provide complete system, including substrate primer/sealer, 40-mil, two component, self-adhering membrane, and appropriate top-coat primer for the material(s) to be placed over the ECB system.
2. Locations for Use: Below all tile flooring, turned up 1-inch at all edges and concealed by base material, and turned down at least 2-inches into floor drains.
3. Completed membrane system is intended for waterproofing, and to bridge substrate joints within the limitations stated in manufacturer's current written product data.

C. Membrane at Walls: No. 15 (6.9 kg) asphalt saturated felt.

D. Mesh Tape: 2 inch (50 mm) wide self-adhesive fiberglass mesh tape.

E. Backer Board: Coated glass mat type complying with ASTM C1178/C1178M; inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder.

F. Mesh Tape: 2 inch (50 mm) wide self-adhesive fiberglass mesh tape.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive tile.

B. Verify wall surfaces are smooth and flat within tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Vacuum clean surfaces and damp clean.

B. Seal substrate surface cracks with filler.

C. Install cementitious backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to feather edge.

D. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108/A118/A136, manufacturer's instructions, and TCNA (HB) or TCNA (HB-GP) recommendations, as applicable.

B. Lay tile to pattern indicated on drawings. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Install thresholds where indicated on drawings.

H. Sound tile after setting. Replace hollow sounding units.

I. Keep control and expansion joints free of mortar, grout, and adhesive.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

K. Grout tile joints unless otherwise indicated. Use epoxy grout unless otherwise indicated.

L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCA Handbook Method F131, epoxy bond coat and grout, unless otherwise indicated.
   1. Use waterproofing membrane under all tile.
   2. Where waterproofing membrane is indicated, install in accordance with TCA Handbook Method F122, with epoxy bond coat and grout.

3.05 INSTALLATION - FLOORS - MORTAR BED METHODS

A. Over exterior concrete substrates, install in accordance with TCA F101, bonded, with grout as indicated in finish schedule on Drawings.

B. Over interior concrete substrates, install in accordance with TCNA (HB) Method F111, with cleavage membrane, unless otherwise indicated on drawings.
   1. Where waterproofing, cleavage, or crack isolation membrane is indicated on drawings, with standard grout or no mention of grout type, install in accordance with TCNA (HB) Method F121.
   2. Where epoxy bond coat and grout are indicated on drawings, install in accordance with TCNA (HB) Method F132, bonded.
   3. Where epoxy or furan grout is indicated on drawings, but not epoxy or furan bond coat, install in accordance with TCNA (HB) Method F114, with cleavage membrane.

C. Over wood substrates, install in accordance with TCNA (HB) Method F141, with standard grout, unless otherwise indicated on drawings.

D. Cleavage Membrane: Lap edges and ends.

E. Mortar Bed Thickness: 1-1/4 inch (31.8 mm), unless otherwise indicated.

3.06 INSTALLATION - WALL TILE

A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

B. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202 thin-set with epoxy bond coat and grout.

3.07 CLEANING

A. Clean tile and grout surfaces.

3.08 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

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SECTION 09 5100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

C. Supplementary insulation above ceiling.

1.02 RELATED REQUIREMENTS

A. Section 07 2100 - Thermal Insulation: Acoustical insulation.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019 (Reapproved 2025).

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2024a.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning and junctions with other ceiling finishes.

C. Product Data: Provide data on suspension system components and acoustical units.

D. Samples: Submit two samples 6 by 6 inch (____by____ mm) in size illustrating material and finish of acoustical units.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 5 percent of total installed (but not less than 100 SF) for each type of acoustical unit.

1.05 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:
   1. Acoustical Panels: Sagging and warping
   2. Grid System: Rusting and manufacturer's defects

B. Warranty Period:
   1. Acoustical panels: Ten (10) years from date of substantial completion.
   2. Grid: Ten (10) years from date of substantial completion.
   3. Acoustical panels and grid systems with HumiGuard Plus or HumiGuard Max performance supplied by one source manufacturer is Thirty (30) years from date of substantial completion.

4. Acoustical panels and grid systems with Humidity/Sag Resistant Treatment supplied by one source manufacturer shall be warranted for Thirty (30) years from date of substantial completion.
5. Acoustical panels and grid systems with Humidity/Sag Resistant Treatment supplied by one source manufacturer shall be warranted for number of years as indicated for each product, from date of substantial completion.
6. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.08 PROJECT CONDITIONS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Install acoustical units after interior wet work is dry.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.

B. USG Corporation: www.usg.com/ceilings/#sle.

C. Substitutions: See Section01 6000-Product Requirements.

2.02 ACOUSTICAL UNITS

A. Acoustical Panels:
   1. As indicated on Ceiling Finish Key.

2.03 SUSPENSION SYSTEMS

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold-down clips, stabilizer bars, clips, and splices as required.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch (2 mm) galvanized steel wire.

C. Perimeter Moldings: Same metal and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

D. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions, as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.

E. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

F. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.

J. Do not eccentrically load system or induce rotation of runners.

K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Install in bed of acoustical sealant.
   2. Use longest practical lengths.

L. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch (25 mm) movement. Maintain visual closure.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Lay directional patterned units with pattern parallel to longest room axis.

D. Fit border trim neatly against abutting surfaces.

E. Install units after above-ceiling work is complete.

F. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

G. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.
   3. Double cut and field paint exposed reveal edges.

H. Where round obstructions occur, provide preformed closures to match perimeter molding.

I. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

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SECTION 09 6500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

C. Installation accessories.

1.02 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

B. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2025.

C. ASTM F1700 - Standard Specification for Solid Vinyl Floor in Modular Format such as Tile(s) or Plank(s); 2025.

D. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021 (Reapproved 2025).

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Shop Drawings: Indicate seaming plans and floor patterns.

D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

E. Verification Samples: Submit two samples, 9 by 9 inch (___ by ___ mm) in size illustrating color and pattern for each resilient flooring product specified.

F. Concrete Testing Standard: Submit a copy of ASTM F710.

G. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.

H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: Provide minimum of 5% of each type and color.
   3. Extra Wall Base: Provide minimum of 5% of each type and color.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect roll materials from damage by storing on end.

1.05 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Luxury Vinyl Tile: LVT-1.
   1. Minimum Requirements: Comply with ASTM F1700, of Class III, Type B - Embossed Surface.
   2. Smoke Developed: 450 or less, when in accordance with ASTM E 662.
   3. Static Load Limit: 1500 psi, when tested in accordance with ASTM F 970 (modified).

4. Size: See Finish Legend.
5. Wear Layer Thickness: 0.022 inch (0.55 mm).
6. Total Thickness: 3/16 inch (4.5 mm).
7. Durability: 0.125 inch - Very Good.
8. Maintainability: 0.125 inch - Excellent.
9. Resilience: 0.125 inch - Excellent.
10. Manufacturer/ Style/ Color: See Finish Legend.

B. Luxury Vinyl Tile: LVT-2
1. Minimum Requirements: Comply with ASTM F1700, of Class III, Type B - Embossed Surface.
2. Static Load Limit: 1500 psi, when tested in accordance with ASTM F 970 (modified).
3. Size: See Finish Legend.
4. Wear Layer Thickness: 0.020 inch (0.50mm)
5. Manufacturer/ Style/ Color: See Finish Legend.

C. Feature Strips: Of same material as tile.

2.02 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
1. Height: See Finish Legend.
2. Thickness: 0.125 inch (3.2 mm).
3. Finish: As selected by Architect.
4. Length: Roll.
5. Accessories: Premolded external corners and end stops.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

C. Moldings, Transition and Edge Strips: Same material as flooring, except where indicated otherwise.

D. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

D. Verify that concrete sub-floor surfaces are dry enough and ready for resilient flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F710; obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

B. Prohibit traffic until filler is fully cured.

C. Clean substrate.

D. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:
   1. Spread only enough adhesive to permit installation of materials before initial set.
   2. Fit joints and butt seams tightly.
   3. Set flooring in place, press with heavy roller to attain full adhesion.

D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
   2. Resilient Strips: Attach to substrate using adhesive.

F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

G. Install flooring in recessed floor access covers, maintaining floor pattern.

H. At movable partitions, install flooring under partitions without interrupting floor pattern.

I. Install feature strips where indicated.

3.04 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.
   1. Apply protective floor polish to resilient flooring surfaces free from soil, excess adhesive or surface blemishes. Use commercially available, metal, cross-linked acrylic product acceptable to resilient flooring manufacturer.
      a. Coordinate selection of floor polish with Owner and/or their maintenance service.
      b. Buff floor tile and provide two (2) coats of a protective floor polish at or near the point of substantial completion.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

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SECTION 09 6813
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

A. Section 09 6500 - Resilient Flooring: Rubber base, and transition strips.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit three carpet tiles illustrating color and pattern design for each carpet color selected.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.05 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. See Finish Legend for Basis of Design products. Approved substitutions listed below, subject to physical sample of each product being approved by Architect:
   1. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Tile Carpeting: See Finish Legend for products.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips: Embossed aluminum, color as selected by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

C. Verify that concrete sub-floor surfaces are dry enough and ready for flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F710; obtain instructions if test results are not within limits recommended by carpet tile manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Locate change of color or pattern between rooms under door centerline.

G. Fully adhere carpet tile to substrate.

H. Trim carpet tile neatly at walls and around interruptions.

I. Complete installation of edge strips, concealing exposed edges.

3.04 PROTECTION

A. Protect installed carpet from damage from construction operations during the remainder of the construction period: use protection materials/methods indicated or recommended in writing by carpet manufacturer.

3.05 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 7200
WALL COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall covering.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Wall substrate.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets for wall covering and adhesive. Indicate compliance with specified flame spread and smoke developed ratings.

C. Shop Drawings: Indicate wall elevations with seaming layout.

D. Samples: Submit two samples of wall covering, 12 by 12 inch (____by____ mm) in size illustrating color, finish, and texture.

E. Manufacturer's Instructions: Indicate installation special procedures.

F. Maintenance Materials: Furnish the following for Owner's use in project maintenance:
   1. See Section 01 6000 - Product Requirements for additional provisions.
   2. Extra Stock Materials: 25 feet (8 m) of each color and pattern of wall covering.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with minimum 3 years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified, with minimum 3 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials for damage upon arrival.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

1.07 FIELD CONDITIONS

A. Maintain adhesive and wall covering manufacturer's recommended temperature ranges 24 hours before, during, and after installation.

PART 2 PRODUCTS

2.01 WALL COVERINGS

A. Performance Requirements:
   1. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 50, maximum, when tested in accordance with ASTM E84.
   2. Wall Covering shall be microvented, or perforated.

B. Wall Covering: Rigid vinyl panel.
   1. Panel Size: 4 by 8 feet (1.2 by 2.4 m).
   2. Rigid Vinyl Thickness: 40 mils, 0.040 inch (1.02 mm).
   3. Panel Edge Treatment: Square.
   4. Trim: Manufacturer's standard trim shapes; vinyl, match face panel color.
   5. Color: See Finish Legend.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify substrate surfaces are primed and meet manufacturer's requirements to receive work.

B. Measure moisture content of substrates with electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.

C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet (3 mm in 3 m) or at rate greater than 1/16 inch/ft (5 mm/m).

D. Notify Architect of detrimental conditions affecting wall covering installation.

E. Correct detrimental conditions before starting installation.

3.02 PREPARATION

A. Remove wall plates and accessories impeding wall covering installation.

B. Wash impervious surfaces with tetra-sodium phosphate; rinse and neutralize; wipe dry.

C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings before preparing surfaces or finishing.

D. Correct surface defects affecting work of this section and clean surfaces. Remove existing coatings exhibiting loose surface defects.

E. Vacuum surfaces to remove loose particles.

3.03 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall immediately before applying wall covering.

C. Use wall covering in roll number sequence.

D. Razor trim edges of wall covering. Do not razor trim on gypsum board surfaces.

E. Smoothly apply wall covering without wrinkles, gaps, or overlaps. Eliminate air pockets and ensure full bond to substrate surface.

F. Horizontal seams are not permitted.

G. Do not seam within 2 inches (51 mm) of internal corners or within 6 inches (152 mm) of external corners.

H. Install wall covering before installing bases and items attached to, abutting, or located within 1 inch (25 mm) of wall surface.

I. Do not install wall covering more than 1/4 inch (6 mm) below top of resilient base.

J. Cover spaces above and below windows and above doors in pattern sequence from roll.

K. Where wall covering tucks into reveals, metal wallboard, or plaster stops, use contact adhesive within 6 inches (152 mm) of wall covering termination. Ensure complete contact bond.

L. Install termination trim.

M. Remove excess adhesive from seams while wet and before proceeding to next wall covering sheet.

N. Reinstall wall plates and accessories removed to accommodate work of this section.

3.04 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

B. Clean wall coverings of dust, dirt, excess adhesive, and other contaminants.

3.05 PROTECTION

A. Protect installed products from damage until mm-dd-yyyy.

END OF SECTION

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SECTION 09 9100
PAINTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints and other coatings.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Exposed surfaces of steel lintels and ledge angles.
   3. Mechanical and Electrical:
      a. In all areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. In all areas, paint shop-primed items.
      c. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
      d. Paint dampers exposed behind louvers, grilles, to match face panels.

D. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Non-metallic roofing and flashing.
   6. Stainless steel, anodized aluminum, bronze, terne, and lead items.
   7. Marble, granite, slate, and other natural stones.
   8. Floors, unless specifically so indicated.
   9. Ceramic and other tiles.
   10. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
   11. Brick, and cast stone.
   12. Exterior insulation and finish system (EIFS).
   13. Glass.
   14. Acoustical materials, unless specifically so indicated.
   15. Concealed pipes, ducts, and conduits.
   16. Door hinges, hardware, or fire door labels.
   17. Rusty or corroded surfaces until sandblasted or wire-brushed free of corrosion, and wiped clean.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 04 2000 - Unit Masonry Assemblies: Faces to be painted in this section.

C. Section 05 5000 - Metal Fabrications: Shop-primed items.

D. Section 08 1113 - Steel Doors and Frames: Shop-primed steel doors and frames.

E. Section 09 2116 - Gypsum Board Assemblies.

F. Section 09 9600 - High-Performance Coatings.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2012.

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

1.04 DEFINITIONS

A. Conform to ASTM D 16 for interpretation of terms used in this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on all finishing products and special coatings, including VOC content.
   1. List each material and cross reference to scheduled paint types, and including each specific coating, finish system, and application. Identify each material by the manufacturer's catalog number and general classification.

C. Samples for initial color selection in the form of manufacturer's color charts from paint/coating manufacturer intended for use.

D. Samples: Submit two paper chip samples, 4x8 inch in size illustrating range of colors available for each surface finishing product scheduled.

E. Samples for verification purposes: Provide samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate. Define each separate coat, including fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.

F. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.

G. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

H. Applicator certifications that are required to be in writing.

I. Submit Manufacture Representative reports as outlined in Field Quality Control below.

J. Coating Maintenance Manual: Upon conclusion of the Project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as S-W "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product / color / finish was used, product data pages, Material Safety Data Sheet (MSDS), care and cleaning instructions, and Touch-up procedures.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

C. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by paint manufacturer, and use only within the recommended limits.

D. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Architect of any problems anticipated using the materials specified, prior to proceeding with work.

E. Material Quality: Provide the manufacturer's best quality grade paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
   1. Proprietary names used to designate colors or materials are not intended to imply that products named are required or to exclude approved equivalent products of other manufacturers.

F. Mock-Up: Provide mock-up at least 3 ft x 3 ft of general wall paint and trim for Architect's and Owner's review. Mock-Up guidelines as described in Section 01 4000 - Quality Requirements.

G. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

H. Lead content in pigments or other painting materials and components is not allowed.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame and smoke rating requirements for products and finishes.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, pigment and vehicle constituents by volume, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

D. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers, others present or passing through or inspecting work areas (painting or any other work), and the work areas themselves are protected from fire and health hazards resulting from handling, mixing, and application of materials.

1.09 PROJECT CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
   1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer, during application, drying and curing periods.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for solvent-thinned Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.10 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Supply 1 gallon of each color and type; store where directed.

C. Label each container with color, type, and room locations in addition to the manufacturer's label.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products from the same manufacturer to the greatest extent possible.

B. Paints:
   1. Sherwin-Williams [Basis of Design]: www.sherwin-williams.com.
   2. Benjamin Moore & Co: www.benjaminmoore.com.
   3. PPG Architectural Finishes, Inc: www.ppgaf.com.

C. Block Fillers: Same manufacturer as top coats.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
   1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
   4. Supply each coating material in quantity required to complete entire project's work from a single production run.
   5. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content:
   1. Provide coatings that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      b. Architectural coatings VOC limits of State in which the project is located.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

D. Colors: As indicated on drawings
   1. In all areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint CppE-OP-3A - Concrete, Poured and Precast:
   1. One Coat: S-W: Loxon Concrete & Masonry Primer, A24W8300, (<100 g/l voc).
   2. Two Coats: S-W: SuperPaint Acrylic Exterior House Paint (Flat, A80-100 series) (Satin, A89-100 Series) (Gloss, A84-100 Series) - Architect to select finish required (<50 g/l voc).

B. Paint CE-OP-3A - Masonry, Opaque, (One filler coat and two acrylic finish coats):
   1. One Coat: S-W: PrepRite Interior / Exterior Acrylic Block Filler, B25W25 (<50 g/l voc) (as required to be pinhole-free).
   2. Two Coats: S-W: SuperPaint Exterior Acrylic House Paint, Gloss, A84-100 Series (<50 g/l voc).

C. Paint GEfibcem-OP-3A - Fiber Cement Board, Acrylic Primer and Paint, 3 Coat:

1. One Coat: S-W: Loxon Latex Primer, A24 (if unprimed).
2. Two Coats: S-W: A100 Exterior Acrylic House Paint, A82. More coats if needed to cover all fibering. Sheen: As selected from gloss or satin.

D. Paint GE-OP-3A - Gypsum Board, Plaster & FRP, Opaque, Acrylic Primer and Paint, 3 Coat:
1. One Coat: S-W: Exterior Latex Primer, B42W8041 (<100 g/l voc).
2. Two Coats: S-W: SuperPaint Exterior Acrylic House Paint, Flat, A80-100 Series (<50 g/l voc).

E. Paint ME-OP-3A - Ferrous Metals, Unprimed, 100% Acrylic, 3 Coat:
1. One Coat: S-W: Pro Industrial Pro-Cryl Universal Metal Primer, B66-310 (<100 g/l voc).
2. Two Coats: S-W: Sher-Cryl High Performance Acrylic, Gloss, B66-300 (<200 g/l voc).

F. Paint ME-OP-2A - Ferrous Metals, Primed, Acrylic Latex, 2 Coat:
1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
2. Two Coats: S-W: Sher-Cryl High Performance Acrylic, Gloss, B66-100 (<200 g/l voc).

G. Paint MgE-OP-3A - Galvanized Metals, Acrylic, Opaque, 3 Coat:
1. One Coat: S-W: Pro Industrial Pro-Cryl Universal Metal Primer, B66-300 (<100 g/l voc).
2. Two Coats: S-W: Sher-Cryl High Performance Semi-Gloss, B66-350 (<200 g/l voc).

2.04 PAINT SYSTEMS - INTERIOR

A. Paint WI-OP-3A - Wood, Opaque, Acrylic Latex, 3 Coat:
1. One Coat: S-W: Multi-Purpose Interior / Exterior Latex Primer /Sealer, B51-450 Series (<50 g/l voc).
2. Two Coats: S-W: ProMar 200 Zero VOC Interior Latex EgShel Enamel, B20-2600 (0 g/l voc).

B. Paint WI-TR-VS - Wood, Transparent, Varnish, Stain:
1. Filler coat: S-W: As required.
2. One coat of stain; S-W: WoodClassics “250” Interior Wood Stain, A49-800 Series (<250 g/l voc). Option: S-W: MinWax “250” VOC Stain (<250 g/l voc).
3. One coat sealer; S-W: none required.
4. Two coats; S-W: WoodClassics Waterbased Polyurethane, A68 Series (<350 g/l voc). Option: MinWax Waterbased Polyurethane Varnish: Satin (710337), Semi-Gloss (710320), Gloss (710313) (<350 g/l voc).

C. Paint CppI-OP-3A - Concrete, Poured and Precast, Opaque, Acrylic, 3 coats.
1. One Coat: S-W: Loxon Concrete & Masonry Primer, A24W8300 (<100 g/l voc).
2. Two Coats: S-W: ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel, B31-2600 (0 g/l voc).

D. Paint CI-OP-3L - Masonry, Opaque, Latex, 3 Coat:
1. One Coat: S-W: Pro Industrial Heavy Duty Block Filler, B42W150. (Required to be pin-hole free).
2. Two Coats: ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel, B31-2600 (0 g/l voc).

E. Paint MI-OP-3A - Ferrous Metals, Unprimed, Acrylic, 3 Coat:
1. One Coat: S-W: Pro Industrial Pro-Cryl Universal Acrylic Primer, B66-310 (<100 g/l voc).
2. Two Coats: S-W: ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel, B31-2600 (0 g/l voc).

F. Paint MI-OP-2A - Ferrous Metals, Acrylic Primed, Acrylic-Alkyd Finish, 2 Coat:
1. One Coat: Touch up with primer: S-W: Pro Industrial Pro-Cryl Universal Acrylic Primer, B66-310 (<100 g/l voc).
2. Two Coats: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Semi-Gloss B34-8200 Series.

G. Paint MgI-OP-3A - Galvanized Metals, Acrylic, 3 Coat:
1. One Coat: S-W: Pro Industrial Pro-Cryl Universal Primer, B66-310 (<100 g/l voc).

2. Two Coats: S-W: ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel, B31-2600 (0 g/l voc).

H. Paint CI-OP-3E - Concrete/Masonry [Inside Face of Single-Wythe Exterior Concrete Block Walls, and in Rest Rooms and other Wet Areas], Epoxy Enamel, 3 Coat:
1. One Coat: S-W: Kem Cati-Coat HS Epoxy Filler Sealer, B42W400. (Required to be pin-hole free) (Trowel to smooth finish may be required).
2. Two coats of waterborne epoxy polyamide (two-component, chemically-cured waterborne epoxy coating for use as a high performance architectural coating). S-W: Pro Industrial Water Based Catalyzed Epoxy (B73-300, Gloss) or (B73-360 EgShel). Architect to select finish required.

I. Paint GI-OP-3E - Gypsum Board, Epoxy, 3 Coat:
1. One coat of best commercial grade acrylic drywall primer, or as recommended by paint manufacturer. S-W: ProMar 200 Zero VOC Interior Latex Primer, B28-2600 (0 g/l voc).
2. Semi-gloss: Two coats of S-W K46 Pro Industrial Precatalyzed Waterbased Epoxy. Scrub Resistance: 500-600 cycles per ASTM D 2486. MPI # 141, & 153, (145 g/L).

J. Paint GI-OP-3LA - Gypsum Board/Plaster, Latex-Acrylic, 3 Coat:
1. One Coat: S-W: ProMar 200 Zero VOC Interior Latex Primer, B28-2600 (0 g/l voc).
2. Two Coats: S-W: ProMar 200 Zero VOC Interior Latex EgShel, B20-2600 (0 g/l voc). (Where Sheen is indicated "Gloss", provide Pro Industrial™ High Performance Acrylic, B66-600 Series, <50 g/l voc).

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Gypsum Wallboard: 12 percent.
2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

E. All surfaces to be pinhole free.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

H. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

I. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

J. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-PC 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).

K. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

L. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

M. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

N. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

O. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Identify fire walls, smoke barriers, etc., in accessible concealed floor, floor-ceiling or attic spaces, by stenciling "X-HOUR FIRE AND/OR SMOKE BARRIER" in 3-inch high contrasting letters, 3/8-inch minimum stroke. Locate within 15 feet of end of wall, and at intervals not exceeding 30 feet measured horizontally along the wall or partition.

B. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

C. Apply products in accordance with manufacturer's instructions.

D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

F. Apply each coat to uniform appearance.

G. All surfaces shall be pinhole-free.

H. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

I. Sand wood and metal surfaces lightly between coats to achieve required finish.

J. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

K. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

L. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Refer to Division 23 and 26 Sections for scheduling of color coding of equipment, duct work, piping, and conduit.

B. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

C. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

B. Architect shall approve surface prior to finish coats being applied.

C. Manufacturers Representative shall visit the site a minimum of 3 times. These visits shall be at the beginning , middle and completion of work.
   1. The beginning visit shall review the substrate for compliance prior to installation and for appropriate use of products.
   2. The middle visit shall review the progress and performance of the installer.
   3. The final visit shall review the quality of the final product.
   4. The manufacturer shall submit reports to the Contractor and the Architect within 72 hours of each visit. The letter shall document observations, instructions to Contractor, and any remediations required and/or completed.

3.06 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean paint from all electrical devices, mechanical devices, door hardware, architectural items, and other permanent materials.

3.07 PROTECTION

A. Protect finished coatings until completion of project.

B. Touch-up damaged coatings after Substantial Completion.

3.08 SCHEDULE - SURFACES TO BE FINISHED

A. Paint the surfaces described in PART 2, Paint Systems Articles.

3.09 SCHEDULE - PAINT SYSTEMS

A. Concrete Block: Finish all surfaces exposed to view.
   1. Exterior: CE-OP-3A, gloss.
   2. Interior: CI-OP-3L, semi-gloss.
   3. Interior: CI-OP-3E, gloss, or egg shell; as selected, or scheduled.

B. Concrete, Poured and Precast: Finish all surfaces exposed to view, unless indicated otherwise.
   1. Exterior: CppE-OP-3A, select finish.
   2. Interior: CppI-OP-3A, semi-gloss.

C. Gypsum Board: Finish all surfaces exposed to view.
   1. Exterior, FRP, Urethane: GE-OP-3A, flat.
   2. Exterior, Glass mat faced soffit: GEsof-OP-3A, satin.
   3. Interior Walls and Gyp Bd Ceilings in Wet Areas: GI-OP-3E, Semi-gloss.
   4. Interior Ceilings and Walls: GI-OP-3LA, eggshell (Except gloss, where indicated).

D. Wood: Finish all surfaces exposed to view.
   1. Interior trim and frames: WI-OP-3A, eggshell.
   2. Interior trim: WI-TR-VS, satin, semi-gloss, gloss.

E. Steel Doors and Frames: Finish all surfaces exposed to view.
   1. Exterior: ME-OP-2A, gloss.
   2. Interior: MI-OP-2A, semi-gloss.

F. Steel Fabrications: Finish all surfaces exposed to view.
   1. Exterior: ME-OP-3A, gloss; finish all surfaces, including concealed surfaces, before installation.
   2. Interior: MI-OP-3A, semi-gloss.

G. Galvanized Steel: Finish all surfaces exposed to view.
   1. Exterior: MgE-OP-3A, semi-gloss.
   2. Interior: MgI-OP-3A, semi-gloss.

END OF SECTION

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SECTION 09 9600
HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High performance coatings.
   1. Coatings for Exterior Use: 3-coat high performance system.

B. Surface preparation.

1.02 RELATED REQUIREMENTS

A. Division 5 - Structural & Miscellaneous Steel.

B. Section 09 9100 - Painting: Requirements for mechanical and electrical equipment surfaces.

1.03 REFERENCE STANDARDS

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

B. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

C. SSPC-SP 11 - Power-Tool Cleaning to Bare Metal; 2020.

1.04 DEFINITIONS

A. Coatings: Paint or heavy duty finishes for use on surfaces subject to interior and exterior exposure, submergence, high moisture, splash, or chemical environment, including primers, sealers, fillers, and intermediate and finish coats.

B. Normal: Surfaces subject to normal temperature and humidity.

C. First Coat: Field primer, factory primer, or shop primer. When only one coat is required, first coat is the finish coat.

D. Second, Third, Intermediate, or Finish coats: Successive finish coats applied over first coat.

E. DFT: Dry Film Thickness (Mils/coat).

F. Sfpg: Square feet per gallon (per coat).

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating coating materials.
   1. Manufacturer's literature including application recommendations and generic makeup for each coating scheduled.
   2. List each material and cross-reference the specific coating, finish system, and application.
   3. Submit one copy of manufacturer's Material Safety Data Sheets (MSDS) for each type of coating to Architect.
   4. Post copy of MSDS on the Site at all times when coating is in progress.

C. Samples: Submit two samples 8 by 8 inch (203 by 203 mm) in size illustrating colors available for selection.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Maintenance Data: Include cleaning procedures and repair and patching techniques.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Coating Materials: 1 gallon (4 liters) of each type and color.
   2. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.06 QUALITY ASSURANCE

A. Regulatory Requirements: All coatings shall conform to OSHA requirements for allowable exposure to lead and other hazardous substances.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

D. Single-Source Responsibility: Provide coating material produced by the same manufacturer for each system.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to the site in original containers with labels intact and seals unbroken.

B. Protect and heat or cool material storage location to maintain temperature ranges recommended by coating manufacturers, but not less than 50 degrees F.

C. Oily rags and waste must be removed from buildings each night or kept in appropriate metal containers. Provide fire extinguishers of the type recommended by coating manufacturers in areas of storage and where finishing is occurring. Allow no smoking or open containers of solvent.

D. Empty containers shall have labels canceled and clearly marked as to use.

1.08 FIELD CONDITIONS

A. Environmental Requirements:
   1. Relative humidity conditions as specified by coating manufacturer shall be adhered to.
   2. Do not apply exterior coating when cold damp, foggy, or rainy weather appears probable, or when the temperature of the substrate is below 50 degrees F., unless approved in writing by the coating manufacturer.
   3. Maintain the manufacturer's environmental requirements until the coating is fully cured.
   4. Apply no coating in areas where dust is being generated.
   5. Restrict traffic from area where coating is being applied or is curing.

B. Protection:
   1. Drop cloths shall be provided in all areas where coating is performed to fully protect other surfaces.
   2. Remove hardware, accessories, plates, lighting fixtures, and similar items or provide protection by masking. Upon completion, replace items or remove protection and clean.

C. Upon substantial completion, remaining unused material will become property of the Owner. Seal material as required for storage, mark contents with color, type, location, and shelf life, and store on Site where required by Owner.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Manufacturer's Warranty: Manufacturer shall provide a 15-year color and gloss warranty that shall conform to the warranty offered by Basis-of-Design manufacturer.

D. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. High-Performance Coatings:
   1. Tnemec Company, Inc: www.tnemec.com/#sle.
   2. Substitutions: Section 01 6000 - Product Requirements.
      a. Each request for substitution shall include the name of the specified material for which a substitute is being requested; name of the proposed substitute material; and a complete description of the proposed substitute including performance and test data, cure times, recoat windows, and generic composition. No request for

substitution will be considered that would decrease film thickness or offer a change in the generic type of coating specified.

b. Substitution requests shall be received by the Architect no later than 10 days prior to bid date.

2.02 SYSTEM DESCRIPTION

A. Coating System for Exterior: Coating on Steel Frame at Portecochere structure.
   1. Exterior Exposed Ferrous Metals (Including Shop-primed Coat, Field-applied Intermediate Coat and Finish Coat):
      a. Surface Preparation: SSPC SP-6 Commercial Blast Cleaning. Angular surface profile shall be 1.5 - 2.0 mils.
      b. Primer/Shop Coat: Organic Zinc-Rich Urethane Primer.
         1) Dry Film Thickness: 2.5 - 3.5 mils.
         2) Product: Tnemec Series 90-97 Tneme-Zinc Exterior Primer.
      c. Intermediate Coat:
         1) Dry Film Thickness: 3.0 - 5.0 mils.
         2) Product: Tnemec Series 66 Hi-Build Epoxoline.
      d. Finish Coat:
         1) Dry Film Thickness: 2.0 - 3.0 mils.
         2) Product: Tnemec Series 73 Endura-Shield.
      e. Total Dry Film Thickness: 7.5 - 11.5 mils.
         1) Scheduled thickness or coverage rate is the minimum recommended by Tnemec Company, Inc. If another manufacturer is used, manufacturer's recommendations shall be followed, but in no case shall the thickness or coverage rate be less than scheduled.

2.03 COLORS, MIXING, AND THINNING

A. Color shall be formed by pigments free of lead, lead compounds, or other materials that might be affected by the presence of hydrogen sulfide or other gases likely to be present at the Site.

B. Where thinning is necessary, only the products of the manufacturer furnishing the coating will be allowed. All such thinning shall be done in strict accordance with the coating manufacturer's recommendations.

C. Mix in accordance with the manufacturer's recommendations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not begin application of coatings until substrates have been properly prepared.

C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

3.02 FIELD QUALITY CONTROL/JOB STANDARDS

A. Prior to commencing the installation, the contractor shall install, with the owner's approval, a mutually agreed upon test sample to show final color and texture of the system. This test area shall serve as a job standard for the final installation.

3.03 PREPARATION

A. Clean surfaces of loose foreign matter.

B. Applicator must report, in writing, surfaces left in improper condition by other trades. Application will constitute acceptance of surfaces by applicator.

C. Prepare surfaces as required, per manufacturer's printed instructions.

D. Where surface dryness is questioned, test with a dampness-indicating instrument. Do not apply coatings over surfaces where moisture content exceeds that permitted by the coating manufacturer.

E. Remove finish hardware, fixture covers, and accessories and store.

F. Ferrous Metal:
   1. Ferrous metal unprimed or shop-primed with an incompatible primer shall be abrasive blast cleaned prior to the application of a primer. Blast cleaning shall conform to SSPC-SP6 for all ferrous surfaces to be coated with a high performance system.
   2. Ferrous metal previously primed or coated with the specified primer shall be cleaned in accordance to SSPC-SP11 for damaged areas and touch-up. Surface cleaning shall include solvent cleaning to remove soluble contaminants. Where the existing applied coating is of unknown origin, a test patch shall be applied to confirm compatibility with the scheduled coating.

3.04 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Ferrous structural steel shall be shop-primed. Field touch-up, where necessary, shall consist of surface preparation specified in Preparation paragraph.

3.05 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in MPI - Architectural Painting and Specification Manual.

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

C. Surfaces shall be dry at time of application.

D. The minimum surface temperature shall be 50 degrees F and rising unless noted otherwise.

E. Apply in strict accordance to the manufacturer's recommendations by brush, roller, spray or other application method. The number of coats and thickness required is the same regardless of application method.

F. Each coat shall be allowed to dry in accordance to the manufacturer's requirements. Drying time shall be construed to mean "under normal conditions". Where conditions other than normal exist, because of weather or because of confined space, longer times will be necessary.

G. Coatings shall be applied to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, or other surface imperfections will not be acceptable. Areas cut-in by brush prior to rolling shall have uniform appearance in comparison to adjoining surfaces.

H. Edges of coatings adjoining other materials or other colors shall be sharp and clean without overlapping.

I. Crevices and other hard to apply areas shall be back-rolled/back-brushed in conjunction with the prime coat.

J. Where multiple coats of the same material are applied, each undercoat shall be slightly different in shade to facilitate identifying each coat.

3.06 FINAL TOUCH-UP

A. Prior to substantial completion, examine the coated surfaces and retouch or refinish surfaces to leave in condition acceptable to the Architect.

3.07 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. Remove masking, coatings, and other material from floors, glass, and other surfaces not scheduled to be coated.

D. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

E. Leave work areas in clean condition.

3.08 PROTECTION

A. Protect the completed work from water, airborne particles or other surface contaminants for a minimum of 24 hours after application.

B. Protect from traffic, physical abuse, immersion and chemical exposure for 24 hours at 75 degrees F. For different temperatures, consult the manufacturer's representative for curing times.

END OF SECTION

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SECTION 10 1100
VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related work specified elsewhere includes:
   1. Section 04 2000 - Unit Masonry.
   2. Section 06 1000 - Rough Carpentry: Wood blocking.
   3. Section 09 2116 - Gypsum Board Assemblies.

1.02 SUMMARY:

A. This Section includes the following types of factory-built visual display boards:
   1. Porcelain Enamel Steel Finish Markerboards.
   2. Vinyl covered cork tackboards.
   3. Anodized aluminum trim systems and accessories.
   4. Glass enclosed tack boards.

B. All markerboards and tackboards shall be 4'-0" in height by lengths indicated on the Drawings.

1.03 SUBMITTALS:

A. General: Submit the following in accordance with Conditions of the Contract and Division 1 Specification Sections.
   1. Product Data: Include manufacturer's data substantiating that tackboard materials comply with requirements indicated.
   2. Shop Drawings: Provide shop drawings for each type of markerboard, and tackboard required. Include sections of typical trim members and dimensioned elevations. Show anchors, grounds, reinforcement, accessories, layout, and installation details.
   3. Samples: Provide the following samples of each product for selection of colors, patterns, and textures, as required, and for verification of compliance with requirements indicated.
      a. Markerboards: Manufacturer's standard color charts consisting of actual sections of markerboard material and finish required, and where colors are not pre-selected, also showing the full range of colors available for each type of markerboard required.
      b. Tackboards: Manufacturer's standard color charts consisting of actual sections of tackboard material and finish required, and where colors are not pre-selected, also showing the full range of colors, textures, and patterns available for each type of cork tackboard indicated.
      c. Aluminum Trim and Accessories: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4-inch squares of sheet or plate, showing the full range of colors available, or pre-selected colors. Where finishes involve normal finish, texture, and/or color variations, include sets showing the full range of variations expected.
   4. Certificates: In lieu of laboratory test reports, when permitted by the Architect, submit the manufacturer's certification that cork tackboard materials furnished comply with requirements specified for flame spread ratings.
   5. Warranty: Provide manufacturer's sample warranty for each product proposed to be furnished. Upon acceptance, furnish actual executed warranty to the Contractor for submittal with Project Closeout Documents.

1.04 QUALITY ASSURANCE:

A. Fire Performance Characteristics: Provide tackboards with surface burning characteristics indicated below, as determined by testing assembled materials composed of facings and backings identical to those required in this section, in accordance with ASTM E 84, by a testing organization acceptable to authorities having jurisdiction.

1. Flame Spread: 25 or less.
2. Smoke Developed: 10 or less.

B. Design Criteria: The drawings indicate size, profiles, and dimensional requirements of visual display boards and are based on the specific type and model indicated.
   1. Substitutions: Other visual display boards having equivalent performance characteristics by other manufacturers may be considered provided that deviations in dimensions and profiles are minor and do not change the design concept or intended performance as judged by the Architect. The burden of proof of equality is on the proposer.
   2. Refer to Section 01 0150 - "Special Conditions", for requirements and time limits for submitting requests for substitutions.

C. Toxin-Free: Provide tackboard and markerboard products and assemblies which are free of any toxins, asbestos, harmful by-products, and carcinogens, including in part, all adhesives and glues.
   1. Tackboards shall be in compliance with Military Specification MIL-C-15116-C, Type II.

D. Single Source Responsibility: Provide all markerboards, tackboards, trim, and accessories by one manufacturer for the entire project, unless otherwise accepted by Architect in writing.

1.05 PROJECT CONDITIONS:

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting; Coordinate with the work of other trades. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.
   1. Allow for trimming and fitting wherever taking field measurements before fabrication might delay the Work.

1.06 WARRANTY:

A. Provide manufacturer's standard written warranty for each markerboard and tackboard product furnished.

PART 2 - PRODUCTS

2.01 MANUFACTURERS/PRODUCTS:

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
   1. Porcelain Enamel Steel Finish Markerboards:
      a. American Visual Display Products, LLC.
      b. Best-Rite Chalkboard Co.
      c. Carolina Chalkboard Co.
      d. Claridge Products and Equipment, Inc.
      e. Greensteel, Inc.
      f. Lemco, Inc.
      g. Marsh Chalkboard Co.
      h. Nelson Adams Co.
      i. Newline Products, Inc. (501) 472-2479
      j. Platinum Visual Systems (800) 498-2990
   2. Tackboards:
      a. American Visual Display Products, LLC.
      b. Best-Rite Chalkboard Co.
      c. Carolina Chalkboard Co.
      d. Claridge Products and Equipment, Inc.
      e. Greensteel, Inc.
      f. Lemco, Inc.
      g. Marsh Chalkboard Co.
      h. Nelson Adams Co.

i. Newline Products, Inc. (501) 472-2479
j. Platinum Visual Systems (800) 498-2990

B. Products: Subject to compliance with requirements, provide equivalent to the following products by one of the above named manufacturers.
1. Porcelain Enamel Steel Finish Markerboards (24-gage; color: White):
a. Equivalent to Claridge Products and Equipment, Inc.; "LCS."
2. Tackboards (color as selected):
a. Vinyl fabric on cork underlay with 1/4” hardboard backing. Equivalent to Claridge Products and Equipment, Inc.; "Fabricork #1380".
3. Aluminum Trim and Accessories (color as selected):
a. Equivalent to Claridge Products and Equipment, Inc.; "Series 1."
4. Glass Enclosed Tack Board:
a. Equivalent to Excel Series Indoor Enclosed Bulletin Board, as marketed by US Markerboard, sized as indicated, satin aluminum frame finish, shatter-resistant glass, lockable doors.
5. Equivalent Products by those manufacturers named above, and/or other manufacturers properly submitted (refer to Section 01 0150 - “Special Conditions”) at least 10 days prior to original Bid Date and subsequently accepted by Architect in writing or by Addendum will be acceptable.
6. Colors: As selected by Architect.
7. Sizes: Refer to Drawings.

2.02 MATERIALS:

A. Tackboard Core: Provide the manufacturer's standard 1/4-inch-thick tempered hardboard core material.

B. Markerboard Core: Provide the manufacturer's standard 1/2-inch thick particle board material.

C. Backing Sheet: Provide the manufacturer's standard 0.005-inch thick aluminum foil backing.

D. Laminating Adhesive: Provide the manufacturer's standard moisture-resistant thermoplastic-type adhesive.

E. Porcelain Enamel Steel Finish Markerboards: Provide 1/2-inch-thick particle board panel surfaced with the manufacturer's 24-gage steel sheet and porcelain enamel finish formulated for matte marker-receptive finish and for use of magnetic devices.
1. Provide with 0.005-inch thick aluminum foil backing.

2.03 ACCESSORIES:

A. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062-inch-thick aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units wherever possible; keep joints to a minimum. Miter corners to a neat, hairline closure.

B. Marker/Chalktray: Furnish manufacturer's standard continuous box-type aluminum marker/chalktray with slanted front and cast aluminum end closures for each markerboard.

2.04 FABRICATION:

A. Assembly: Provide factory-assembled markerboard and tackboard units, except where field-assembled units are required.
1. Make joints only where total length exceeds maximum manufactured length. Fabricate with the minimum number of joints, balanced around the center of the board, as acceptable to the Architect.
2. Provide manufacturer's standard mullion trim at joints between contiguous markerboard and tackboard.

2.05 FINISHES:

A. General: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Class II Clear Anodized Finish: AA-M12C22A31 (Mechanical Finish: as fabricated, nonspecular; Chemical Finish: etched, medium matte; Anodic Coating: Class II Architectural, clear film thicker than 0.4 mil).
   1. Provide color anodized in lieu of clear, upon request by Architect.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Deliver factory-built markerboard and tackboard units completely assembled in one piece without joints, wherever possible. Where dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to the Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.

B. Install units in locations and at mounting heights indicated and in accordance with the manufacturer's instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for a complete installation.
   1. Mounting Height: Top of markerboard and tackboard units shall align and be at 7'-0" above finished floor, unless otherwise indicated.

3.02 ADJUST AND CLEAN:

A. Verify that accessories required for each unit have been properly installed and that operating units function properly.

B. Clean units in accordance with the manufacturer's instructions. Break in markerboards only if and as recommended by the manufacturer.

END OF SECTION

SECTION 10 1400
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cash allowance for signs.

B. Room and door signs.

C. Interior directional and informational signs.

D. Emergency evacuation maps.

E. Building identification signs.

F. Plaque.

1.02 RELATED REQUIREMENTS

A. Section 01 2100 - Allowances.

B. Section 04 2000 - Unit Masonry.

C. Section 09 2116 - Gypsum Board Assemblies.

D. Division 22 Section - Identification for Plumbing Piping and Equipment.

E. Division 26 Section - Identification for Electrical Systems.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2100 - Allowances, for cash allowances affecting this section.

1.04 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.

1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
3. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

F. Verification Samples: Submit samples showing colors specified.

G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Curved Sign Media Suction Cups: Two; for removing media.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.08 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs:
1. Best Sign Systems, Inc: www.bestsigns.com/#sle.
2. Mohawk Sign Systems, Inc: www.mohawksign.com/#sle.
3. Seton Identification Products: www.seton.com/aec/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Curved Signs:
1. Vista System; V200 Series: www.vistasystem.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

C. Dimensional Letter Signs:
1. Leeds Architectural Letters, Inc.
2. Substitutions: See Section 01 6000 - Product Requirements.

D. Plaques:
1. Leeds Architectural Letters, Inc.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. All Signage Types: Unless otherwise indicated:
1. Character Font: Block lettering, sans serif, as selected.
2. Character Case: Upper and lower case (title case).
3. Background Color: As indicated on drawings, or as selected.
4. Character Color: Contrasting or as noted.

C. Interior Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
1. Sign Type: Curved signs with engraved panel media as specified.
2. Provide "tactile" signage, with letters raised minimum 1/32 inch (0.8 mm) and Grade II braille.
3. Use ADA Insert Panel, as specified.
4. Character Height: 1 inch (25 mm).
5. Sign Height: 6 inches (150 mm), unless otherwise indicated.
6. Sign Width: 8 inches, unless otherwise indicated.

7. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings.
8. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings.
9. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings. Sign sizes: 4" x 8", unless indicated otherwise.
10. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", as indicated on drawings, room numbers to be determined later, and braille.
11. Transparent Insert: Printable on common ink-jet or laser printer. Provide one (1) printed insert per sign based on occupant list to be provided at later date. Provide one (1) extra blank insert per door.
12. Opaque Insert: Provide up to six (6) options for background graphic design based on color and direction to be provided by Architect at later date.

D. Exterior: Flat panel, satin aluminum metal background, with black lettering. Sign size: 6" x 8".

E. Interior Directional and Informational Signs:
1. Sign Type: Same as room and door signs.
2. Sizes: As indicated on drawings.
3. Where suspended, ceiling mounted, or projecting from wall signs are indicated, provide two-sided signs with same information on both sides.

F. Emergency Evacuation Maps:
1. Allow for maps at locations indicated.
2. Map content to be provided by Owner.
3. Use clear plastic panel silk-screened on reverse, in brushed aluminum frame, screw-mounted.

G. Building Identification Signs:
1. Use individual metal letters.
2. Mount on outside wall in location indicated on drawings.

H. Plaque: At inside of entrance as directed by Architect.

2.03 SIGN TYPES

A. Flat Signs: Signage media without frame.
1. Edges: Square.
2. Corners: Square.
3. Clear Cover: For customer produced sign media, provide clear cover of polycarbonate plastic, glossy on back, non-glare on front.
4. Wall Mounting of One-Sided Signs: Tape adhesive.
5. Wall and Ceiling Mounting of Two-Sided Signs: Aluminum wall bracket, powder coated, color selected from manufacturer's standard colors, attached with screws in predrilled mounting holes, set in clear silicone sealant.
6. Suspended Mounting: Stainless steel suspension cables, cable clamps, and ceiling fastener suitable for attachment to ceiling construction indicated.

B. Radius / Curved Signs: One-piece, curved extruded aluminum media holder securing flat, flexible sign media by curved lip on two sides; other two sides closed by end caps; concealed mounting attachment.
1. Sizes: As indicated on drawings.
2. Finish: Natural (clear) anodized.
3. Sign Orientation: Curved in horizontal section.
4. End Caps: Aluminum with finish matching frame and stainless steel screw attachment.
5. ADA Insert - Clear, non-glare plastic lens with permanently affixed raised letters and braille. Size and thickness: As recommended by manufacturer.
6. Wall Mounting of One-Sided Signs: Mechanical anchorage, with predrilled holes, and set in clear silicone sealant.

7. Wall and Ceiling Mounting of Two-Sided Signs: Aluminum wall bracket, powder coated, color selected from manufacturer's standard colors, attached with screws in predrilled mounting holes, set in clear silicone sealant.
8. Suspended Mounting: Stainless steel suspension cables, cable clamps, and ceiling fastener suitable for attachment to ceiling construction indicated.

C. Radius / Curved Signs: One-piece, curved extruded aluminum media holder securing flat, flexible sign media by curved lip on two sides; other two sides closed by end caps; concealed mounting attachment.
1. Size: As specified, unless otherwise indicated.
2. Finish: Natural (clear) anodized.
3. Sign Orientation: Curved in horizontal section.
4. End Caps: Aluminum with finish matching frame and stainless steel screw attachment.
5. ADA Insert - Clear, non-glare plastic lens with permanently affixed raised letters and braille. Size and thickness: As recommended by manufacturer.
6. Wall Mounting of One-Sided Signs: Mechanical anchorage, with predrilled holes, and set in clear silicone sealant.
7. Wall and Ceiling Mounting of Two-Sided Signs: Aluminum wall bracket, powder coated, color selected from manufacturer's standard colors, attached with screws in predrilled mounting holes, set in clear silicone sealant.
8. Suspended Mounting: Stainless steel suspension cables, cable clamps, and ceiling fastener suitable for attachment to ceiling construction indicated.

D. Color and Font: Unless otherwise indicated:
1. Character Font: Helvetica, Arial, or other sans serif font.
2. Character Case: Upper case only.
3. Background Color: Clear.
4. Character Color: Contrasting color, to be selected by Architect.

2.04 TACTILE SIGNAGE MEDIA

A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
1. Total Thickness: 1/16 inch (1.6 mm).
2. Panel Edges: Square.
3. Panel Corners: Square.

2.05 NON-TACTILE SIGNAGE MEDIA

A. Silk Screened Plastic Panels: Letters and graphics silk screened onto reverse side of plastic surface:
1. Sign Color: Clear.
2. Total Thickness: 1/8 inch (3 mm).

2.06 PLAQUES

A. Metal Plaques: As detailed in Conditions of Contract.
1. Metal: Aluminum casting.
2. Casting shall be free from pits, scale, sand holes, or other defects.
3. Hand-tool and buff borders and raised copy to produce manufacturer's standard satin polished finish.
4. Background Finish: Provide dark statuary finish (Kynar 500).
5. Background Texture: Manufacturer's standard sand texture, or as selected.
6. Back of Plaque: Seal with manufacturer's standard clear, transparent, and non-yellowing lacquer, or similar finish with same characteristics and acceptable to Architect; two coats minimum.

2.07 DIMENSIONAL LETTERS

A. Metal Letters: Height and size as indicated on drawings. Letters shall be cut or cast from aluminum and finished with two (2) coats of baked enamel finish. Color to be selected by Architect.
   1. Font: As selected by Architect, in vector-based art file, with approval of Owner.
   2. Mounting: Concealed screws. Threaded stud with 3-inch offset spacers. Mounting template designating stud locations is required for all mounting surfaces. At cementitious cladding system, mount studs through cladding panel and into steel blocking.
   3. Ensure substrate material warranties are not impacted by sign installation.

B. Locations and Sizes of Letters:
   1. As indicated on drawings.

2.08 ACCESSORIES

A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

B. Tape Adhesive: Double sided tape, permanent adhesive.

C. Use clear, silicone sealant.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs where indicated:
   1. Mechanically fasten to CMU or gypsum board. Adhesive tape is not approved or acceptable.

D. Cast Metal Plaques: Mount plaque using the standard method recommended by the manufacturer for the type of wall surface indicated.
   1. Concealed Mounting: Mount the plaque by inserting threaded studs into tapped lugs on the back of the plaque. Set in pre-drilled holes filled with quick-setting cement.

E. Building Lettering: Mount letters onto building using the standard method recommended by the manufacturer for the type of surface indicated.
   1. Concealed Mounting: Unless recommended otherwise by manufacturer, mount the letters by inserting threaded studs into tapped lugs on the back of the letters. Set in pre-drilled holes filled with quick-setting cement. At cementitious cladding system, mount studs through cladding panel and into steel blocking.

3.03 PROTECTION

A. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION

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SECTION 10 2113.17
PHENOLIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Phenolic toilet compartments.

B. Urinal screens.

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry: Compartment wall & screen construction.

B. Section 06 1000 - Rough Carpentry: Blocking and supports.

C. Section 09 2116 - Gypsum Board Assemblies: Wall construction.

D. Section 10 2800 - Toilet Accessories.

1.03 REFERENCE STANDARDS

A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

D. Samples: Submit two samples of partition panels, 6 by 6 inch (____by____ mm) in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Phenolic Toilet Compartments:
   1. ASI Accurate Partitions; _____: www.asi-accuratepartitions.com/#sle.
   2. Ampco Products, Inc: www.ampco.com.
   3. Atlanta Sunbelt Products: www.atlantasunbelt.com.
   4. Columbia Partitions by PSISC: www.psisc.com.
   5. Scranton Products (Santana/Comtec/Capital): www.scrantonproducts.com.
   6. Substitutions: Section 01 6000 - Product Requirements.

2.02 COMPONENTS

A. Toilet Compartments: Solid Phenolic panels, doors, and pilasters, floor-mounted headrail-braced unless indicated otherwise.
   1. Color: To be selected from manufacturer's full range of Phenolic colors.

B. Door and Panel Dimensions:
   1. Thickness: 3/4 inch, minimum.
   2. Door Width: 24 inch (610 mm) unless indicated otherwise.
   3. Door Width for Handicapped Use: 36 inch (915 mm), out-swinging.
   4. Height: 58 inch (1 473 mm).
   5. Thickness of Pilasters: 3/4 inch, minimum.
   6. Urinal Screens: Wall-mounted with one continuous bracket.

2.03 ACCESSORIES

A. Pilaster Shoes: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 3 inch (76 mm) high, concealing ceiling fastenings.
   1. Provide ceiling attachment using two adjustable hanging studs, attached to above-ceiling framing.

B. Head Rails: Hollow stainless steel, 1 inch by 1 inch (25 mm by 25 mm) size, with anti-grip profile and cast socket wall brackets.

C. Pilaster Brackets: Satin stainless steel; manufacturer's standard type for conditions indicated on drawings.

D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.

E. Hardware: Satin stainless steel:
   1. Hinge: 14 gauge continuous.
   2. Nylon bearings.
   3. Door Latch: Slide type with exterior emergency access feature.
   4. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   5. Coat hook with rubber bumper; one per compartment, mounted on door.
   6. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch (9 mm to 13 mm) space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch (6 mm).

B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 2600
WALL PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Protective Wallcovering

1.02 SUBMITTALS

A. Comply with requirements of Section 01 3300 – Submittals.

B. Product Data: Submit manufacturer's product data including installation instructions.

C. Samples: Submit 7" x 9" sample of each type, thickness, color, and texture to be installed for Architect's approval.

D. Certification: Submit manufacturer's certification indicating Protective Wallcovering meets specified requirements.

E. Maintenance Instructions: Submit manufacturer's maintenance instructions for Protective Wallcoverings.

1.03 QUALITY ASSURANCE

A. Provide Protective Wallcovering that conforms to applicable codes including IBC, UBC, SBCCI, BOCA, Life Safety, and CA01350.

B. Installer Qualifications: Use installer experienced in the installation of Protective Wallcovering on projects of similar size and complexity.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacture's original unopened containers and packaging with labels clearly indicating manufacturer and material.

B. Storage:
   1. Store materials indoors in a clean, dry area protected from damage and in accordance with manufacturer's instructions.
   2. Maintain storage temperature above 50°F (10°C).
   3. Store materials flat. Do not stand rolls or sheet on end.

C. Handling: Protect materials during handling and installation to prevent damage.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain constant minimum air temperature of 65°F (18°C) for a minimum of 48 hours before and during installation.

B. Maintain wall temperature between 65°F (18°C) and 85°F (29°C) during installation.

C. Do not expose walls to direct sunlight during or after installation.

D. Do not install if relative humidity is greater than 80%.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Koroseal Wall Protection Systems; Korogard (Basis of Design): www.koroseal.com.

B. Substitutions: See Section 01 6000

2.02 PROTECTIVE WALLCOVERING

A. Fire Rating: Class A

B. Thickness: 0.040"

C. Color: As selected by Architect from manufacturer's standard colors.

2.03 ADHESIVES

A. Furnish adhesives approved by Protective Wallcovering manufacturer.

2.04 ACCESSORIES

A. Accessory Moldings: Furnish accessory moldings by Protective Wallcovering manufacturer to ensure accurate match of colors, dimensions, and physical properties.

B. Caulk: Furnish color matched caulk by Protective Wallcovering manufacturer to ensure accurate match of colors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect wall surfaces to receive Protective Wallcovering. Notify the Architect in writing if wall surfaces are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Prepare walls in accordance with manufacturer's written instructions.

B. Remove dust, dirt, grease, oil, loose paint, scale, and existing wallcovering.

C. Resurface uneven wall surfaces and damaged walls.

D. Seal walls with white prime seal.

3.03 INSTALLATION

A. Install Protective Wallcovering to walls in accordance with manufacturer's written instructions.

B. Allow Protective Wallcovering and adhesive to precondition for a minimum of 24 hours at a temperature between 65°F (18°C) and 85°F (29°C) before installation.

C. Install sheets with texture running in the same direction for uniform appearance.

3.04 CLEANING

A. Clean Protective Wallcovering in accordance with manufacturer's instructions.

B. Remove excess adhesive and layout marks.

END OF SECTION

SECTION 10 2601
WALL AND CORNER GUARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to this Section.

B. Section : Blocking for wall and corner guard anchors.

C. Section 09 2116 - Gypsum Board Assemblies.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

1.04 SUBMITTALS

A. See Section , for submittal procedures.

B. Product Data: Indicate .

C. Shop Drawings showing locations, extent and installation details of corner guards. Show methods of attachment to adjoining construction.

D. Samples: Submit two sections of corner guard, 12 inch (____ mm) long, illustrating component design, end cap attachment and mounting hardware, color and finish.

E. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Manufacturer's qualifications: Not less than 5 years experience in the production of specified products, and a record of successful in-service performance.

B. Installer's qualifications: Not less than 3 years experience in installation of systems similar in complexity to those required for this project.

C. Code compliance: Assemblies shall conform to all applicable codes, including IBC, UBC, SBCCI, BOCA and Life Safety.

D. Fire performance characteristics: Provide wall protection system components with UL label indicating that they are identical to those tested in accordance with ASTM E84 for Class 1 characteristecs listed below:
   1. Flame spread: 25 or less.
   2. Smoke developed: 450 or less.

E. Single source responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the project site in unopened original factory packaging clearly labeled to show manufacturer.

B. Store materials in original, undamaged packaging in a cool, dry place out of direct sunlight and exposure to the elements. A minimum room temperature of 40 deg F. and maximum of 100 deg. F should be maintained.

C. Store materials flat.

1.07 WARRANTY

A. Provide manufacturer's 1-year warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Wall and Corner Guards:
   1. Construction Specialties Inc./Acrovyn : www.c-sgroup.com.
   2. Koroseal/Korogard: www.korogard.com.
   3. IPC; InPro Corp [Basis of Design]: www.inprocorp.com.
   4. Johnsonite, Inc.: www.johnsonite.com.
   5. Nystrom, Inc: www.nystrom.com/#sle.

2.02 MATERIALS

A. Engineered PETG: Extruded material high impact Acrovyn 4000, with shadowgrain texture. Chemical and stain resistance shall be per ASTM D543 standards as established by manufacturer. Nominal 0.078" thick. Color: As selected from manufacturer's standard range.

B. Aluminum Retainer: Extruded aluminum of 6063-T6 alloy, nominal .075" thickness. Minimum strength and durability properties shall be as specified in ASTM B221.

2.03 COMPONENTS

A. Corner Guards - Surface Mounted: Acrovyn 4000; Resilient corner guards, with self adhesive tape backing.
   1. Size: 1-1/2 inches.
   2. Corner: Square.
   3. Color: As selected, unless indicated.
   4. Length: One piece, 48", unless indicated otherwise.
   5. Product: Construction Specialties Acrovyn VA-200N.
   6. /////VA-034N with 3/4" legs/////VA250N with 2-1/2" legs/////

B. Corner Guards - Surface Mounted: Engineered PETG extruded material - Acrovyn 4000, with 1/4" radius cover.
   1. Size: 3 inch legs.
   2. Height: Full height.
   3. Retainer: PVC-free regrind retainer for 90 degree angle.
   4. Color: As selected, unless indicated.
   5. Product: Construction Specialties SM-20N.

C. Corner Guards - Flush Mounted: Engineered PETG corner guards consisting of aluminum retainer with snap-on Acrovyn 4000 cover. Extruded aluminum base and closure gasket where indicated. Attachment hardware shall be appropriate for wall construction.
   1. Product: CS Acrovyn SFS-20N (or approved equal) full height 90 degree flush mounted corner guard.
      a. Size: 2 inch legs.
      b. Corner: 1/4-inch radiused.
      c. Aluminum Retainer, feathered, attach to gypsum assembly, for flush mounting. To be taped and spackled into adjacent drywall.
      d. Length: One piece, extending 3" above ceiling.
      e. Color: As selected from manufacturer's standard colors.
      f. Location: At all exposed gypsum outside corners.

2.04 ACCESSORIES

A. Fasteners: As recommended by manufacturer.

B. Adhesive: As recommended by manufacturer.

2.05 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Pre-drill holes for attachment.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to wall framing members only.

B. Corner guards shall be securely adhered to the wall and installed per the manufacturer's recommended instructions.

C. Temperatures at the time of installation must be between 65 deg F. and 75 deg F. and be maintained for at least 48 hours after installation.

3.03 TOLERANCES

A. Maximum Variation From Required Height:

B. Maximum Variation From Level or Plane For Visible Length:

3.04 CLEANING

A. Immediately upon completion of installation, clean vinyl covers and accessories in accordance with manufacturer's recommended cleaning method.

B. Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

3.05 PROTECTION

A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

END OF SECTION

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SECTION 10 2800
TOILET ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates.
   1. Public-use washroom accessories
   2. Warm-air dryers
   3. Childcare accessories
   4. Underlavatory guards
   5. Custodial accessories

1.03 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Include electrical characteristics.

B. Samples: Full size, for each exposed product and for each finish specified.
   1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.
   2. Identify products using designations indicated.

1.05 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.07 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from a single source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.08 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, visible silver spoilage defects.
   2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 OWNER-FURNISHED MATERIALS

A. Owner-Furnished Materials: TA08, TA15.

2.02 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.03 MANUFACTURER

A. Basis-of-Design Products: Subject to compliance with requirements, provide the listed Basis-of-Design Products.
   1. Bobrick Washroom Equipment, Inc. (Basis-of-Design Product Manufacturer)

2.04 SLOAN VALVE COMPANY (SOAP DISPENSERS ONLY)

A. Koala (Childcare Accessories Only)

B. Plumberex (Underlavatory Guards Only)
   1. Or comparable products by one of the following:
      a. American Specialties, Inc.
      b. Bradley Corporation.
   2. Alternate products submitted for consideration (from one of the manufacturers listed above) must show an itemized comparison with each product named below.

2.05 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue Dispenser (Standard Roll): **TA01**
   1. Basis-of-Design Product: Bobrick B-2840
      a. Description: Double-roll dispenser with utility shelf.
      b. Mounting: Surface mounted.
      c. Operation: Non-control delivery with theft-resistant spindle.
      d. Capacity: Up to 5 1/2-inch diameter tissue rolls.
      e. Material and Finish: Stainless steel, No. 4 satin finish, with high impact, black, polystyrene spindles.

B. Paper Towel Dispenser, Automatic (Roll): TA08 [OFCI]

C. Waste Receptacle, Surface Mount, Large: TA11
   1. Basis-of-Design Product: Bobrick B-277
   2. Mounting: Surface Mounted.
   3. Minimum Capacity: 12.75 gallon.
   4. Material and Finish: Stainless steel, No. 4 satin finish.
   5. Waste Receptacle Profile: Arc-front.
   6. Trash Liner Holder: Removable holding device designed to facilitate installation and removal of disposable trash liners and to retain liner inside waste receptacle. Device shall have a molded plastic sleeve with a stainless steel U-shaped support strap.

D. Soap Dispenser, Liquid Type, Manual: TA15 [OFCI]

E. Grab Bar (short): TA20
   1. Basis-of-Design Product: Bobrick B-6806 x 18
   2. Mounting: Flanges with concealed fasteners.
   3. Material and Finish:
      a. Material: Stainless steel, 0.05 inch thick.
      b. Finish: Smooth, No. 4 satin finish on ends and slip-resistant texture in grip area.
      c. Outside Diameter: 1-1/2 inches.
      d. Configuration and Length: Straight, 18 inches long.

F. Grab Bar (medium): TA21
   1. Basis-of-Design Product: Bobrick B-6806 x 36

2. Mounting: Flanges with concealed fasteners.
3. Material and Finish:
   a. Material: Stainless steel, 0.05 inch thick.
   b. Finish: Smooth, No. 4 satin finish on ends and slip-resistant texture in grip area.
   c. Outside Diameter: 1-1/2 inches.
   d. Configuration and Length: Straight, 36 inches long.

G. Grab Bar (long): TA22
1. Basis-of-Design Product: Bobrick B-6806 x 42
2. Mounting: Flanges with concealed fasteners.
3. Material and Finish:
   a. Material: Stainless steel, 0.05 inch thick.
   b. Finish: Smooth, No. 4 satin finish on ends and slip-resistant texture in grip area.
   c. Outside Diameter: 1-1/2 inches.
   d. Configuration and Length: Straight, 42 inches long.

H. Mirror, Framed, without Shelf: TA23
1. Basis-of-Design Product: Bobrick B-165-2436
2. Frame: Stainless steel channel.
3. Corners: Mitered, welded, and ground smooth.
4. Hangers: Produce rigid, tamper and theft-resistant installation, using one-piece, galvanized steel, wall hanger device with spring action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
5. Size: 24 inches wide x 36 inches high.

I. Grab Bar: TA24
1. Basis-of-Design Product: Bobrick B-6806 x 24
2. Mounting: Flanges with concealed fasteners.
3. Material and Finish:
   a. Material: Stainless steel, 0.05 inch thick.
   b. Finish: Smooth, No. 4 satin finish on ends and slip-resistant texture in grip area.
   c. Outside Diameter: 1-1/2 inches.
   d. Configuration and Length: Straight, 24 inches long.

J. Grab Bar: TA25
1. Basis-of-Design Product: Bobrick B-6806 x 12
2. Mounting: Flanges with concealed fasteners.
3. Material and Finish:Material:
   a. Stainless steel, 0.05 inch thick.
   b. Finish: Smooth, No. 4 satin finish on ends and slip-resistant texture in grip area.
   c. Outside Diameter: 1-1/2 inches.
   d. Configuration and Length: Straight, 12 inches long.

K. Robe Hook: TA26
1. Basis-of-Design Product: Bobrick B-6717
2. Mounting: Surface mounted.
3. Material and Finish: Stainless steel, No. 4 satin finish.

L. Sanitary Napkin Disposal Unit, Surface-mount: TA29
1. Basis-of-Design Product: Bobrick B-35139
2. Mounting: Surface mounted.
3. Door or Cover: Self-closing disposal opening cover and hinged face panel.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, No. 4 satin finish.

2.06 WARM AIR DRYERS

A. Warm Air Dryer: TA50

1. Basis-of-Design Product: Bobrick B-7128-115V
2. Mounting: Surface mounted.
3. Operation: Electronic sensor activated with timed power cut-off switch.
   a. Operation time: 30 to 40 seconds.
   b. Cover Material and Finish: Stainless steel, No. 4 satin finish.
   c. Electrical Requirements: 115V, 15A, 1725W.

2.07 CHILDCARE ACCESSORIES

A. Diaper-Changing Station: TA55
   1. Basis-of-Design Product: Koala KB310-SSWM
   2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
      a. Engineered to support a minimum of 250-lb static load when opened.
      b. Mounting: Surface mounted, with unit projecting not more than 4 inches from wall when closed.
      c. Operation: By pneumatic shock-absorbing mechanism.
      d. Material and Finish: Stainless steel, No. 4 satin finish.
      e. Liner Dispenser: Built in.

2.08 UNDERLAVATORY GUARDS

A. Underlavatory Guard: TA58
   1. Basis-of-Design Product: Plumberex Soft Guard Plus
   2. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
   3. Material and Finish: Antimicrobial, molded plastic, white.

2.09 CUSTODIAL ACCESSORIES

A. Mop and Broom Holder: TA60
   1. Basis-of-Design Product: Bobrick B-224 x 36
   2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
   3. Length: 36 inches.
   4. Hooks: Three.
   5. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
   6. Material and Finish: Stainless steel, No. 4 satin finish.
      a. Shelf: Not less than nominal 0.05 inch thick stainless steel.
      b. Rod: Approximately 1/4-inch-diameter stainless steel.

2.10 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.11 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of ____ keys to Owner's representative.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.02 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer’s written recommendations.

END OF SECTION 102800

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SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Knox Boxes.

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry.

B. Section 06 1000 - Rough Carpentry: Wood blocking.

C. Section 09 2116 - Gypsum Board Assemblies: Roughed-in wall openings.

1.03 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; Current Edition.

B. NFPA 10 - Standard for Portable Fire Extinguishers; 2026.

C. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, and mounting measurements for wall bracket.

C. Operation and Maintenance Data: Include test, refill, or recharge schedules and recertification requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature causes freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 FIRE EXTINGUISHERS

A. General Requirements: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated on drawings.

B. Multipurpose Dry-Chemical-Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Stored Pressure Operated: Deep drawn.
   2. Class: A:B:C.
   3. Size and classification: UL-rated 4-A: 60-B: C, 10 pound nominal capacity.
   4. Finish: Baked polyester powder coat, red color.
   5. Extent: For all locations indicated, except kitchen or food prep areas.
   6. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to 120 degrees F (49 degrees C).

C. Wet Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gauge.
   1. Class: K.
   2. Size and classification: UL-rated 10K, 5-pound nominal capacity.
   3. Finish: Polished stainless steel.
   4. Temperature Range: Minus 20 to 120 degrees F (Minus 29 to 49 degrees C).
   5. Extent: For kitchen and food prep areas.

2.02 FIRE EXTINGUISHER CABINETS

A. Metal: Formed primed steel sheet; 0.036 inch (0.9 mm) thick base metal.

B. Cabinet Configuration: Semi-recessed type, unless otherwise shown.
   1. Size to accommodate accessories.
   2. Trim: Flat rolled edge, with 2.5 inch (____ mm) wide face.

C. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with continuous piano hinge. Door style equal to Larsens "Vertical Duo".

D. Door Glazing: Acrylic plastic, clear, 1/8 inch (3 mm) thick, flat shape, and set in resilient channel glazing gasket.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with predrilled holes for placement of anchors.

F. Fabrication: Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: Baked enamel, white color.

H. Finish of Cabinet Interior: White colored enamel.

2.03 ACCESSORIES

A. Extinguisher Brackets: Formed steel, galvanized and enamel finished.

B. Cabinet Signage: Red letters: "Fire Extinguisher".

C. Knox Box: Product - Recessed, heavy duty, 10 key, Series 3200. Quantity: 1 per building. www.knoxbox.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and interfaces with other work.

B. Verify substrate and site conditions for product installation are in accordance with manufacturer's written instructions.

C. Verify rough openings for cabinet are sized and located in accordance with manufacturer's written instructions.

D. Notify Architect in writing of conditions detrimental to completion of work. Do not proceed with installation until detrimental conditions are corrected.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings; see drawings for mounting height, or, if not indicated, at height to comply with applicable regulations of governing authorities.

C. Where exact location of cabinets and bracket-mounted fire extinguishers is not indicated, locate as directed by Architect.

D. Secure rigidly in place.

E. Install one fire extinguisher in each fire extinguisher cabinet, and as indicated.

F. Recessed installation of Knox Boxes: location to be coordinated with local Fire Marshal. Install according to manufacturer's recommendations.

END OF SECTION

SECTION 10 5623
WIRE STORAGE SHELVING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wall mounted wire shelving.

B. Accessories.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 1 Specification Sections, apply to this Section.

B. Section 09 2116 - Gypsum Board Assemblies: Blocking in metal stud walls for attachment of standards.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, with installation instructions.

C. Shop Drawings: Provide drawings prepared specifically for this project; show dimensions of shelving and attachment to substrates.

D. Selection Samples: For each color selection required, submit color chips representing manufacturer's full range of available colors and finish.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

C. Store flat to prevent warpage and bending.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Wire Storage Shelving:
   1. ClosetMaid Corporation "ShelfTrack": www.closetmaid.com.
   2. Organized Living: www.organizedliving.com.
   3. RubberMaid Closet and Organization Products : www.rubbermaidcloset.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SHELVING APPLICATIONS

A. Shelf Depth: See Drawings.

B. Laundry Room: Configuration as indicated. Close-mesh cross wire spacing (1/2").

2.03 MATERIALS

A. Wire Shelving: Factory-assembled coated wire mesh shelf assemblies for wall-mounting, with all components and connections required to produce a rigid structure that is free of buckling and warping.
   1. Construction: Cold-drawn steel wire with average tensile strength of 100,000 psi resistance welded into uniform mesh units, square, rigid, flat, and free of dents or other distortions, with wires trimmed smooth.
   2. Coating: PVC or epoxy, applied after fabrication, covering all surfaces.
   3. PVC Coating: 9 to 11 mils thick.

4. Epoxy Coating: Non-toxic epoxy-polyester powder coating baked-on finish, 3 to 5 mils thick.
5. Shelf and Rod Units: Integral hanging rod at front edge of shelf.

B. Wall-Mounted Standards: Vertically slotted channel standards with double-tab cantilever brackets to suit shelving; factory finished to match shelving.

C. Fasteners: As recommended by manufacturer for mounting substrates.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect areas to receive shelving, to verify that spaces are properly prepared to receive shelf units, and are of dimensions indicated on shop drawings.

B. Verify appropriate fastening hardware.

C. Do not begin installation until substrates have been properly prepared.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, with shelf surfaces level.

B. Cap exposed ends of cut wires.

C. Install back clips, end clips at side walls, and support braces at open ends. Install intermediate support braces as recommended by manufacturer.

D. Mounting Heights:
1. See drawings.

3.04 CLEANING

A. Clean soiled surfaces after installation.

3.05 PROTECTION

A. Protect installed work from damage.

B. Touch-up, repair, or replace damaged products before Substantial Completion in a manner that eliminates evidence of replacement.

END OF SECTION

SECTION 10 7316
CANOPIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work in this section includes furnishing and installation of extruded aluminum canopy.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 03 3100 - Concrete.

C. Section 04 2000 - Unit Masonry.

D. Section 05 5000 - Metal Fabrications.

E. Section 07 6200 - Sheet Metal Flashing and Trim.

F. Section 07 9005 - Joint Sealers.

1.03 REFERENCE STANDARDS

A. Aluminum Design Manual 2000, Specifications & Guidelines for Aluminum Structures.

B. ASCE 7, Minimum Design Loads for Buildings and Other Structures.

C. American Architectural Manufacturer's Association (AAMA).

D. American Society for Testing and Materials (ASTM).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's product information, specifications and installation instructions for building components and accessories.

C. Shop Drawings: Indicate all necessary plan dimensions, elevations and details. General Contractor shall verify all dimensions and provide elevations at each column, finish floor, and related soffit before releasing to manufacturer for fabrication.

D. Certification: Submit design calculations signed by a Registered Professional Engineer, licensed in Alabama. Design calculations shall state that the canopy system complies with the wind requirements of ASCE 7-95, the applicable building code, and all other governing criteria.

E. Warranty: Submit manufacturer's warranty (as described below) and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience, and approved by manufacturer.

D. Wind Uplift: Provide roof and vertical panel systems including supports meeting requirements of Underwriters Laboratories, Inc. for Class 90 wind uplift resistance.
   1. Minimum Code Wind Load at Site: 90 mph (IBC 2006).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store all canopy components in protected areas.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Canopy system, including materials and workmanship, shall be warranted from defects for a period of one year from substantial completion of installation.

C. Provide 10 year manufacturer warranty for canopy system remaining intact (without perceptible deformation) and completely leak-free for 10-years from date of acceptance of project (this warranty need not cover damage from winds exceeding the velocities and/or loading required by the International Building Code.

D. Provide 20 year manufacturer warranty covering finish of canopy when finished with fluoropolymer coating.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Architectural Shade Products; [Basis of Design]: www.architecturalshade.com.

B. Mapes Canopies: www.mapes.com.

C. Mason Corporation: www.masoncorp.com.

D. Mitchell Metals: www.mitchellmetals.net.

E. Peachtree Protective Covers: www.peachtreecovers.com.

F. Tennessee Valley Metals, Inc.,: www.tvmetals.com.

G. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Structural Components (including but not limited to decking, beams, posts, fascia, channels, tubes, angles, mounting plates and hanger rods) shall be extruded aluminum, alloy 6063-T6.

B. Fasteners: aluminum, 18-8 stainless steel or 300 series stainless steel.

2.03 COMPONENTS

A. Columns: Columns shall be radius-cornered tubular extrusion of size indicated, with cutout and internal diverter for drainage where required.

B. Beams: Beams shall be open-top tubular extrusion of size and shape indicated, top edges thickened for strength and designed to receive deck members in self-flashing manner. Provide structural ties in tops of all beams.

C. Channels, Tubes, Angles, Hanger Rods, and Mounting Plates: Structural aluminum extrusions

D. Deck: Deck shall be extruded self-flashing sections interlocking into a composite unit.

E. Fascia: Fascia shall be size and shape as indicated.

F. Flashing: Flashing shall be .040" aluminum (min.).

2.04 FABRICATION

A. Columns and gutter beams shall be designed such that the columns will be notched to receive and secure the gutter beams.

B. Support channels and beams shall be designed to receive and secure the gutter beams.

C. Beams shall be positively connected with neatly mitered corners.

D. Deck shall be manufactured of extruded modules that interlock in a self-flashing manner. Assemble deck with sufficient camber to offset dead load deflection.

E. Concealed drainage: Water shall drain from covered surfaces into integral gutter beam and be directed to ground level discharge via one or more designated support posts.

2.05 FACTORY FINISHING

A. Fluoropolymer (Kynar) finish: AAMA 2605, three coat.

B. Color: Selected from manufacturer's standard colors.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrates are ready to receive work.

3.02 PREPARATION

A. Erection shall be performed after all concrete, masonry, and roofing work in the vicinity is complete and cleaned.

3.03 INSTALLATION

A. Installation shall be in strict accordance with manufacturer's recommendations and approved shop drawings.

B. Blockouts, if required, shall be provided by manufacturer, and installed by General Contractor.

C. Erect beams true to line, level and plumb.

D. Aluminum columns embedded in concrete shall be protected by acrylic.

E. Downspout columns shall be filled with grout to the discharge level to prevent standing water.

F. Non-draining columns shall have weep holes installed at top of concrete to remove condensation.

3.04 CLEANING

A. After installation, entire system shall be left in a clean condition.

3.05 PROTECTION

A. Protect the finish during handling and erection.

B. Take all precautions needed to protect entire canopy system from damage during subsequent construction activity until time of Substantial Completion.

END OF SECTION

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SECTION 11 3100
KITCHEN AND LAUNDRY EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Kitchen appliances.

B. Laundry appliances.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Division 22 Section for Plumbing Piping: Plumbing connections for appliances.

C. Division 26 Section for Equipment Wiring: Electrical connections for appliances.

1.03 REFERENCE STANDARDS

A. UL (EAUED) - Electrical Appliance and Utilization Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.

C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Electric Appliances: Listed and labeled by UL and complying with NEMA standards.

C. Gas Appliances: Bearing design certification seal of AGA.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.

PART 2 - PRODUCTS

2.01 KITCHEN APPLIANCES

A. All Equipment Eligible for Energy Star Rating: Energy Star Rated.

B. Refrigerator : Free-standing, side-by-side, frost-free.
   1. Capacity: Total storage of 21.7 cubic ft (____ cu m)____.
   2. Features: Include glass shelves.
   3. Finish: Stainless steel.
   4. Slideout Spillproof Shelves: 3 minimum.
   5. Width: 32-3/4 inches, maximum.
   6. Depth: 33-5/8 inches.
   7. Height: 66-5/8 inches.
   8. Location: See drawings.
   9. Manufacturer/Product: Whirlpool WRS312SNH.
   10. Other Manufacturers:
      a. GE Appliances: www.geappliances.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

C. Microwave, Commercial: Countertop: Capacity: 0.8 cu.ft.; Power Rating: 1000 watts; Exterior Dimensions: 20-1/8"W x 16-1/2"D x 12"H; 6 minute dial timer.
   1. Door Finish: Stainless steel.
   2. Power Source: 120V, 60Hz, Single Phase.
   3. Finish and color: Satin Stainless Steel.
   4. Location: See Drawings.
   5. Manufacturers:
      a. GE: www.geappliances.com.
      b. Kenmore Appliances: www.kenmore.com.
      c. Panasonic Commercial Microwave Oven Model NE-1025F [Basis of Design]: www.panasonic.com.
      d. Whirlpool Corp.

D. Ice Machine: Nugget Ice Maker and Storage Bin:
   1. Stainless Steel exterior.
   2. Provide with water filter and other required accessories.
   3. Warranty: Minimum 3 year parts and labor on all components. 5 year parts on compressor.
   4. Size: 22"W x 23.63"D x 26"H ice maker. 22"W x 34"D x 44"H storage bin, on 6" legs
   5. Location: See drawings.
   6. Manufacturer/Product: Basis of Design: Manitowocice "RNP0320A" Nugget Ice Machine & "D-240" Storage Bin: www.manitowocice.com
   7. Other Manufacturers:
      a. Ice-O-Matic: www.iceomatic.com.
      b. Scotsman: www.scotsman-ice.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LAUNDRY APPLIANCES

A. Clothes Washer : Front-loading.
   1. Capacity: Approximately 4.5 cu. ft.
   2. ADA Compliant.
   3. Energy Star Compliant.
   4. Controls: - Electronic with LED's.
   5. Cycles: Include normal.
   6. Finish: Painted steel, color white.
   7. Size: Must match dryer. Approximately 39-3/4"H x 28"W x 32"D.
   8. Location: See drawings.
   9. Product: GE Appliance Model# GFW550SSNWW: www.geappliances.com.
   10. Other Manufacturers:
      a. Frigidaire Home Products; Product ____: www.frigidaire.com.
      b. Kenmore: www.kenmore.com.
      c. Whirlpool Corp; Product ____: www.whirlpool.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. Clothes Dryer Type ____: Electric, stationary.
   1. Capacity: Approximately 7.4 cu. ft.
   2. ADA Compliant.
   3. Controls: Electronic with LED's - , with timer dry control.
   4. Temperature Selections: five.
   5. Features: Include interior light and end of cycle signal.
   6. Finish: Painted steel, color white.
   7. Drum: Aluminized Steel.
   8. Size: Must match washer. Approximately 39-3/4"H x 28"W x 32"D.
   9. Location: See drawings.
   10. Product: GE Appliance Model# GFD55ESSNWW: www.geappliances.com.

11. Other Manufacturers:
    a. Frigidaire Home Products; Product ____: www.frigidaire.com.
    b. Kenmore: www.kenmore.com.
    c. Whirlpool Corp; Product ____: www.whirlpool.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify utility rough-ins are present and correctly located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Anchor built-in equipment in place.

3.03 ADJUSTING

A. Adjust operating equipment to efficient operation.

3.04 CLEANING

A. Remove packing materials from equipment.

B. Wash and clean equipment.

END OF SECTION

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SECTION 12 2114
HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. 2" Horizontal faux wood slat louver blinds.

B. Horizontal louver blinds with aluminum slats.

C. Operating hardware.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating physical and dimensional characteristics and operating features.

C. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.

D. Samples: Submit two samples, 6 inch (____ mm) long illustrating slat materials and finish, color, cord type and color.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Blind Assemblies: Two of each size.
   3. Extra Slats: 20 of each type and size.
   4. Extra Lift Cords, Control Cords, and Wands: One of each type.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver product in manufacturer's original packaging.

B. Handle and store product to prevent damage to materials, finishes, and operating mechanisms. Store in a clean, dry area, laid flat to prevent sagging and twisting of packaging.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Horizontal Louver Blinds:
   1. Hunter Douglas: www.hunterdouglas.com.
   2. Levolor Contract: www.levolorcontract.com.
   3. Graber, division of Springs Window Fashions: www.graberblinds.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 BLINDS AND BLIND COMPONENTS

A. Blinds: Horizontal slat louvers hung from full-width headrail with full-width bottom rail; manual control of raising and lowering by cord with full range locking; blade angle adjustable by control wand; complying with WCMA A100.1.
   1. Extent: See drawings.

B. Wood Slats: _____ square or square slat corners, as selected. Resistant to warping.
   1. Width: 2 inch (50 mm).
   2. Thickness: 1/8 inch (____ mm).
   3. Pre-finished to color as selected.

C. Slat Support: Braided 100% polyester yarn, ladder configuration.

D. Head Rail: Pre-finished, formed steel box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.
   1. Dimensions: 2" H x 2-1/4" W x 0.022" thick U-shaped steel.
   2. Finish: Finish steel with phosphate treatment for corrosion resistance, chrome-free sealer, low HAP urethane primer, and topcoat of low HAP polyester baked enamel.
   3. Color: As selected.

E. Bottom Rail: Pre-finished, 9/16" high x 2" wide PVC in rectangular shape to improve closure. Color: As selected.
   1. Finish: Coordinate with slats.

F. Lift Cord: Braided polyester; continuous loop.
   1. Free end weighted.
   2. Color: As selected.

G. Control Wand: Extruded solid plastic; hexagonal shape.
   1. Color: clear.

H. Cord Tilter: Snap-in component incorporating a worm and pulley of low-friction thermoplastic and a nylon gear. Tilt cords shall be secured to pulley and treated with wood tassels at tilt end. Standard cord tilter.

I. Cord Lock: Metal of a snap-in design incorporating a floating shaft type locking pin and shall incorporate a crash proof safety feature that will lock blind automatically upon release of cord. End of lift cords will be treated with wood tassels.

J. Headrail Attachment: Wall brackets.

K. Accessory Hardware: Type recommended by blind manufacturer.

2.03 FABRICATION

A. Determine sizes by field measurement.

B. Fabricate blinds to fit within openings with uniform edge clearance of 1/8 inch (____ mm).

C. At openings requiring multiple blind units, provide separate blind assemblies with space of 1/8 inch (____ mm) between blinds, located at window mullion centers.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that openings are ready to receive the work.

B. Ensure structural blocking and supports are correctly placed.

3.02 INSTALLATION

A. Install blinds in accordance with manufacturer's instructions.

B. Install blinds with adequate clearance to permit smooth operation of the blinds.

C. Secure in place with flush countersunk fasteners.

3.03 INSTALLATION TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch (6 mm).

B. Maximum Offset From Level: 1/8 inch (3 mm).

3.04 ADJUSTING

A. Adjust blinds for smooth operation.

3.05 CLEANING

A. Clean blind surfaces just prior to occupancy.

END OF SECTION

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SECTION 12 3219
LAMINATE CASEWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division 1 - Specification sections, apply to work of this section.

1.02 WORK INCLUDED

A. The extent of manufactured casework systems as shown on drawings, schedules, and specified herein. Where specific materials, finishes, construction details, and hardware are specified herein, the casework contractor shall be held in strict accordance. All items shall be as provided, and publicly cataloged, by the manufacturers to assure physical and dimensional integrity of the system and ready access to additional systems components for a minimum of ten (10) years after completion of this contract. Product from companies not meeting this requirement will not be accepted. It is the intent of the owner and architect and construction manager to have this specification section furnished by one contractor.

B. Furnish and install all fixed, modular, and mobile laminate clad casework, tops and accessories and components, fillers and related items shown on drawings and herein specified. All built-in and modular plastic laminate counter tops and splashes are specified herein and detailed on architectural.

C. Furnish and install all locks for cabinet doors and drawers as indicated on elevations of the architectural drawings.

D. In areas where architectural woodwork, "millwork", and casework are combined or adjacent to one another, millwork and casework are to be fully coordinated and supplied from a single source.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Sinks and service fixtures, service and waste lines and all connections, vents, electrical service fixtures, hoods and ducting within or adjacent to casework, or otherwise required in all areas except Science labs and Science classrooms: Furnished and installed under Mechanical and Electrical Divisions 22-23, and 26.

B. Base molding: Furnished and installed under Finishes Division 9, to be consistent with base molding in room, unless base is not specified, in which case laminate base shall be applied.

C. Appliances, unless specifically noted on plans as included in this section.

D. Furnishing, installing and connecting of service supply lines and conduits within equipment and reagent racks, connecting of exposed service lines, connecting of services in tunnels or service turrets through, under, or along backs of working surfaces as required for utility service fixtures.

E. Installing all utility service outlet accessory fittings and fixtures furnished by casework contractor, pulling of wire and connecting of electrical fixtures in service lines, provision of ground fault protection for circuits requiring such.

F. Receiving, installing and connecting all separate sinks, cup sinks or drains, draining troughs, overflows and sink outlets, as furnished by the casework contractor for the Work Room and Storage Room areas.

G. Furnishing, installing and connecting all traps, tailpieces, backflow prevention devices and special plumbing fittings and piping of unusual nature to meet local codes even though not specifically called for in specifications or shown on drawings.

H. Furnishing and installing of all framing, bucks, metal grounds or reinforcements in walls, floors, ceilings to adequately support and anchor casework and related equipment.

I. Furnishing fluorescent tubes, light bulbs and any miscellaneous materials generally classified as maintenance or supply items.

J. General Contractor or Owner shall furnish hoisting or elevator service, where available, at no charge to casework contractor.

K. Coordination with millwork items as specified in Section 06 4000 - "Architectural Woodwork".

1.04 SYSTEM DESCRIPTION

A. All manufactured casework shall be pre-engineered, and cataloged in a nationally published catalog. Manufacturers submitting for approval must provide printed catalog information documenting this performance feature; no exceptions will be allowed.

1.05 QUALITY ASSURANCE

A. All manufactured casework systems, countertops and related items herein specified shall be furnished be one contractor to insure single source responsibility, and integration with other building trades

B. All manufacturers herein listed, shall show evidence of a minimum of five (5) years experience in providing manufactured casework systems for similar types of projects.

C. Manufacturer shall produce evidence of adequate facilities and personnel required to perform on this project. Financial stability of manufacturer shall be evidenced by readily providing a material performance bond if required.

D. Manufactured casework systems must conform to design, quality of materials, workmanship and function as shown on drawings and specified herein. In the absence of a printed specification, minimum quality standards shall be in accordance with AWI Section 1600B, Sixth Edition, Version 1.1, no exceptions will be permitted; additional requirements shall be as specified herein.

E. Provide independent laboratory testing documenting that the support rail and interfacing components when tested in strict accordance with the requirements of seismic construction codes, all components met or exceeded the requirements as set forth by the codes. All casework bidders must provide a copy of test to architect ten days prior to bid date.

F. All casework bidders must provide the following test results as tested by an independent testing firm:
   1. Racking Test (must exceed 975 lbs.)
   2. Front Joint Load Test (must exceed 635lbs.)
   3. Uniform Load Shelf Test (must exceed 1140 lbs.)
   4. Isolated Shelf Clip Load Test (must exceed 640 lbs.)
   5. Static Load Test (must exceed 1800 lbs with no cabinet failure)
   6. Draw Side Joint Test (must exceed 425 lbs.)
   7. Draw Front Joint Test (must exceed 925lbs.)
   8. Draw Static Load Test (must exceed 900 lbs.)

G. The architect and owner reserves the right to randomly select one 36” wide base cabinet and one 36” wide wall cabinet and one 36” wide tall cabinet from each manufacturer during installation and cut apart to determine if the product installed meets the written specification. The casework manufacturer shall include the price to replace these units in his bid. If the product fails to meet the specification then the casework supplier shall be responsible to make any and all necessary corrections.

1.06 SUBMITTALS

A. Product Data:
   1. In addition to the general conditions as relates to prior approvals, submittals of manufacturer's data, installation instructions, and samples are required upon architect's request.

B. Samples:
   1. Submit samples of casework manufacturer's standard decorative laminate colors, patterns, and textures for exposed and semi-exposed materials for architect's selection. Samples of other materials or hardware shall be made available if requested.

2. Architect may request representative full-size samples for evaluation prior to approval. Samples may be impounded by architect/owner until completion of project to ensure compliance with specifications.
3. Submit copy of Seismic testing report.

C. Production Drawings:
1. Submit production drawings for all casework systems and countertops and required equipment, ends, cross-sections, face modular values, service run spaces and location of services.
2. Include layout of units with relation to surrounding walls, doors, windows, and other building components.
3. Coordinate production drawings with other work involved.

1.07 PRODUCT HANDLING

A. Deliver casework and countertops only after wet operations in building are completed.

B. Store completed casework and countertops in a ventilated place, protected from the weather, with relative humidity range of 20% to 50%.

C. Protect finished surfaces from soiling and damage during handling and installation.

D. General Contractor shall be responsible for protection of all casework and tops after installation is completed.

1.08 JOB CONDITIONS

A. Humidity and Temperature Controls:
1. Before the delivery and installation of casework and equipment, building conditions shall be as follows:
a. The building shall be secure and weather tight, with windows and doors installed, heat and air conditioning systems functional.
b. Walls and openings shall be plumb, straight and square. Concrete floors shall be level within acceptable trade tolerances. Specifically the floor must be within 1/8" of level per 10 foot run, non-accumulative, when tested with a straight edge in any one direction.
c. Flooring required to be placed under casework and equipment must be installed.
d. Wood or metal blocking (wall grounds) shall be installed within partitions prior to delivery of casework and furnishings to allow for immediate installation on delivery.
e. General Contractor shall have heat and air conditioning systems providing consistent temperature and humidity conditions as required Related humidity must be maintained at not less than 25%, nor more than 55%. Temperatures must not range lower than 65 degrees F, not to exceed 80 degrees F in areas of material installation.
f. All overhead mechanical, electrical or plumbing rough-in work shall be complete
g. Any “wet” operation performed by other trades must be complete prior to delivery.
h. Ceiling grids (with or without ceiling tiles), overhead soffits, duct work and lighting shall be installed.
i. Painting shall be complete.
j. General Contractor shall provide a secure storage area within the building that is clean, dry well ventilated, protected from direct sunlight and broom clean.

1.09 WARRANTY

A. The manufacturer shall guarantee all materials and workmanship of equipment provided in this contract for a period of five years from date of final acceptance. This is a warranty of replacement and repair only, whereby the manufacturer will correct defects in materials and/or workmanship without charge. Any defective materials of faulty workmanship occurring within that time shall be replaced or corrected promptly without charge upon notification by the owner or his designated representative. All bidders are to provide to the Architect a copy of the manufacturers warranty for the casework ten (10) days before the bid date.

PART 2 – PRODUCTS

2.01 PLASTIC LAMINATE CASEWORK

A. Manufacturers: Subject to compliance with specifications, provide products by one of the following:
   1. Casework Systems:
      a. TMI Systems Design Corporation.
      b. Case Systems, Inc.
      c. LSI Corporation of America, Inc.
      d. Stevens Industries, Inc.
      e. Jastev Casework.
      f. JIMCO, Inc.
   2. Plastic Laminate: Subject to compliance with requirements, provide solid, stippled, textured, and/or patterned high pressure decorative laminates of one of the following:
      a. Formica Corporation.
      b. Micarta Division, Westinghouse Electric Corporation.
      c. Nevamar Division, International Paper Co.
      d. Ralph Wilson Plastics Co.

B. Substitutions:
   1. It is the intent of this specification to establish performance and quality criteria consistent with pre-established standards of design and function herein described. Casework systems not meeting these minimum standards will not be accepted.
   2. Where specific materials, finish options, construction details, modularity, hardware and test data are specified herein, the casework storage system will be held in strict compliance. Substitutions will be considered prior to bid date provided request is submitted to the architect, in writing, no later than ten (10) days prior to bid date; substitution request shall list any and all deviations from this specification. Requests later than ten (10) days prior to bid will not be considered. Acceptable substitutions will be identified in future addenda.
   3. All manufacturers must submit the following items to the architect ten days prior to bid date to be qualified to bid.
      a. A Copy of required Seismic Testing Data related to rail casework.
      b. ADA Brochure depicting ADA requirements and compliance
      c. All required independent test reports.
      d. A sample of a rail mounted base cabinet and rail chase system demonstrating rail and interfacing system and hardware.
      e. A sample base cabinet of fixed base cabinet with required hardware.
      f. A copy of Guarantee and Limited Warranty.
      g. A detailed deviation list addressing where the requested product deviates from the specified product.

2.02 MATERIALS

A. Core Materials:
   1. MR Moisture Resistant Medium Density Fiberboard: Average 47-pound density grade, ANSI A 208.2.
   2. Medium Density Fiberboard: Average 47-pound density grade, ANSI A 208.2.
   3. Grade AB Plywood

B. Hardboard: 1/4 inch thick prefinished hardboard, CS-251.

C. Decorative Laminates:
   1. High-pressure decorative laminate VGS (.028), NEMA Test LD 3-1995. for vertical surfaces.
   2. High-pressure decorative laminate HGS (.048), NEMA Test LD 3-1995 for horizontal Surfaces.

3. High-pressure decorative laminate HGP (.039), NEMA Test LD 3-1995 for post formed tops.
4. High-pressure cabinet liner CLS (.020), NEMA Test LD 3-1995.
5. High-pressure backer BKH (.048), (.039), (.028), NEMA Test LD3-1995.
6. Thermally fused melamine laminate, NEMA Test LD 3-1995.

D. Laminate Color Selection: Maximum 1 color per unit face and 5 colors per project. (See Color Selection in section 3.05).

E. Edging Materials:
1. 1 mm PVC banding.
2. 3mm PVC banding, machine profiled to 1/8 inch radius, where required and herein specified..

F. Grommets:
1. 2-1/2" x 6" black, plastic oval grommet. See Drawings for location.

G. Glass:
1. Wall unit full sliding glass doors: 1/4 inch laminated safety glass.
2. Glass insert doors, hinged or sliding wall cabinets: 1/4 inch laminated safety glass.
3. Glass insert doors, hinged or sliding tall or base cabinets. 1/4 inch laminate safety glass.
4. Sliding doors mounted in aluminum track.
5. Trim glass inserts: Extruded rigid PVC.

2.03 SPECIALTY ITEMS

A. Metal Parts:
1. Countertop support brackets, undercounter support frames, legs and miscellaneous metal parts shall be furniture steel, welded, degreased, cleaned, treated and epoxy powder painted. Color shall be as selected by Architect from manufacturer's standard colors.

2.04 CABINET HARDWARE

A. Hinges:
1. 170-degree adjustable "CLIP System" concealed self-closing hinges as manufactured by Julius Blum, Inc., or equivalent by Grass or Stanley.
a. Doors 48 inch and over in height shall have 3 hinges per door.

B. Pulls:
1. Wire pulls equivalent to Stanley No. 4484, aluminum satin (ANSI B12012), 4-inches long, with 1-inch clearance; finish to match Section 08 7100 - "Finish Hardware" finish in room(s) where occurs. Pull design shall comply with the Americans with Disability Act (ADA).

C. Drawer Slides:
1. Regular, knee space and pencil slides shall be 100-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers and have a positive stop both directions with self-closing feature. Paper storage units shall have 150-pound load rated epoxy coated steel slides.
2. File: Full extension, Shall have 150-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers and have positive stop both directions with self-closing feature.

D. Adjustable Shelf Supports:
1. Injection molded transparent polycarbonate friction shall fit into cabinet end panels and vertical dividers, adjustable on 32mm centers. Each shelf support shall have 2 integral support pins, 5mm diameter, to interface pre-drilled holes, and to prevent accidental rotation of support. The support shall automatically adapt to 3/4 inch or 1 inch thick shelving and provide a non-tip feature for shelving. Supports may be field fixed if desired. Structural load to 1200 pounds (300 pounds per support) without failure.

E. Locks:

1. Shall be National #M49054, removable core, disc tumbler, cam style lock with strike. Furnish 2 keys. Lock for sliding 3/4 inch doors shall be a disc type plunger lock, sliding door type with strike. Lock for sliding glass / acrylic doors shall be a ratchet type sliding showcase lock.
2. Automatic door bolt shall be Hafele #530-1604, used to secure inactive door on all locked cabinets.

F. Coat Rods: Shall be 1 inch diameter, 14-gauge chrome plated steel installed in captive mounting hardware.

G. File Suspension System: Shall be14-gauge steel file suspension rails, epoxy powder coated. File followers, or other split bottom hardware, will not be acceptable.

2.05 FABRICATION

A. Fabricate casework, countertops and related products to dimensions, profiles, and details shown.

B. Cabinet Body Construction:
1. Tops and bottoms are glued and doweled to cabinet sides and internal cabinet components such as fixed horizontals, rails and verticals.
2. Minimum 6 dowels each joint for 24 inch deep cabinets and a minimum of 4 dowels each joint for 12 inch deep cabinets.
3. Tops, bottoms and sides of all cabinets are 3/4 inch thick particleboard core.
4. Cabinet backs: 1/2 inch thick. Wall and tall cabinets are provided with a 1-inch x 1-3/4 inch PVC mounting strip used to secure the cabinet to the wall.
   a. Exposed back on fixed or movable cabinets: 3/4 inch particleboard with the exterior surface finished in VGS laminate as selected.
   b. Flexible rail mounted cabinet backs: 3/4 inch thick particleboard structurally doweled into cabinet sides and top panels.
5. Fixed base and tall units have an individual factory-applied base, constructed of 3/4 inch exterior grade plywood. Base is 96mm (nominal 4 inch) high unless otherwise indicated on the drawing.
6. Base units, except sink base units: Full sub-top. Sink base units are provided with open top, a welded steel/epoxy painted sink rail full width at top front edge concealed behind face rail/doors, a split back removable access panel.
7. Side panels and vertical dividers shall receive adjustable shelf hardware at 32mm line boring centers. Mount door hinges, drawer slides and pull-out shelves in the line boring for consistent alignment.
8. Exposed and semi exposed edges.
   a. Edging: 1mm PVC
9. Adjustable shelf core: 1 inch thick particleboard up to 36 inches wide, 1-inch thick particleboard with corrugated metal ribbed stiffener for shelves over 36 inches wide.
   a. Front edge: 1mm PVC.
10. Interior finish, units with open Interiors:
   a. Top, bottom, sides, horizontal and vertical members, and adjustable shelving faces with VGS High Pressure decorative laminate.
11. Interior finish, units with closed Interiors:
   a. Top, bottom, sides, horizontal and vertical members, and adjustable shelving faces with thermally fused melamine laminate with matching prefinished back.
12. Exposed ends:
   a. Faced with VGS high-pressure decorative laminate.
13. Wall unit bottom
   a. Faced with thermally fused melamine laminate.
14. Wall and tall unit tops:
   a. Top surface is faced with thermally fused melamine laminate.
15. Balanced construction of all laminated panels is mandatory.

16. Unfinished core stock surfaces, even on concealed surfaces (excluding edges), not permitted.
17. Provide oval grommets 3'-0" o.c. in bracket supported countertops.

C. Drawers:
1. Sides, back and sub front: Minimum 1/2 inch thick particleboard, laminated with thermally fused melamine doweled and glued into sides. Top edge banded with 1mm PVC.
2. Drawer bottom: Minimum 1/2 inch thick particleboard laminated with thermally fused melamine, screwed directly to the bottom edges of drawer box.
3. Paper storage drawers: Minimum 3/4 inch thick particleboard sides, back, and sub front laminated with thermally fused melamine. Minimum 1/2 inch thick particleboard drawer bottoms screwed directly to the bottom edges of the drawer box. Provide PVC angle retaining bar at the rear of the drawer.

D. Door/Drawer Fronts:
1. Core: 3/4 inch thick particleboard.
2. Provide double doors in opening in excess of 24 inches wide.
3. Faces:
   a. Exterior: VGS High-pressure decorative laminate.
   b. Interior: High-pressure cabinet liner CLS.
4. Door/drawer edges: 3mm PVC, external edges and outside corners machine profiled to 1/8 inch radius.
5. Miscellaneous Shelving:
   a. Core material: 3/4 inch or 1 inch particleboard.
   b. Exterior: VGS High-pressure decorative laminate.
   c. Edges: 3mm PVC, external edges and outside corners machine profiled to 1/8 inch radius.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions under provisions of Section 01 7000.

B. Verify that openings are ready to receive work.

C. Verify adequacy of support framing anchors.

D. Verify that required utilities are available. In proper locations and ready for use.

E. Beginning of installation means installer accepts existing surface conditions.

3.02 INSTALLATION

A. Install casework, components and accessories in accordance with manufacturer's instructions.

B. Use anchoring devices to suit condition and substrate materials encountered.

C. Set casework items plumb and square.

D. Install casework attachment rails on wall along entire length of wall to facilitate installation of wall cabinets.

E. Hang wall mounted casework on attachment rails. Level and adjust wall casework using adjustment capabilities of wall unit mounting brackets.

F. Assemble and install worksurface tops on site with use of concealed screws on bases such as base cabinets, pedestals or columns

G. Scribe to abutting surfaces and align adjoining components. Apply matching filler pieces where casework abuts dissimilar construction.

H. Repair small scratches and surface blemishes on units using manufacturer's supplied touch up materials or replace units as required.

3.03 ADJUSTING

A. Adjust work under provisions of Section 01 7000.

B. Adjust doors, drawers, hardware, fixtures, and other moving or operating parts to function smoothly.

3.04 CLEANING

A. Clean work under provisions of Section 01 7000.

B. Clean casework, counters, shelves, glass, legs, hardware, fittings, and fixtures

C. Remove dirt with damp cloth and soap and water. Remove stubborn dirt with non-flammable chlorinated solvents or solvents such as: lacquer thinner, M.E.K., or contact adhesive solvent if area is ventilated sufficiently to prevent build-up of fumes and noticeable odors. Do not use harsh abrasive cleaners.

3.05 PROTECTION OF FINISHED WORK

A. Protect finished work under provisions of Section 01 7000.

B. Do not permit finished casework to be exposed to continued construction activity.

C. Protect finished casework from damage by water, heat and other causes until final acceptance.

D. Replace casework exhibiting warpage, surface discoloration, and damage at no additional cost to owner.

END OF SECTION

SECTION 12 4813
ENTRANCE FLOOR MATS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet mat.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating properties of walk-off surface, component dimensions and recessed frame characteristics.

C. Shop Drawings: Indicate dimensions and details for recessed frame.

D. Samples: Submit two samples, ___ by ___ inches (___ by ___ mm) in size illustrating pattern, color, finish, and edging.

PART 2 PRODUCTS

2.01 FLOOR MATS

A. Carpet Mat: Cut nylon pile permanently bonded to vinyl backing; 24 inch (609.6 mm) wide by 24 inches (609.6 mm) long.
   1. Colors: As indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor opening for mats are ready to receive work.

3.02 INSTALLATION

A. Install walk-off surface in floor recess flush with finish floor after cleaning of finish flooring.

END OF SECTION

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SECTION 21 0451

GENERAL FIRE PROTECTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all labor, materials, equipment, and services necessary for the design, fabrication, installation, testing, and commissioning of fire protection systems as indicated on the Contract Documents and specified herein, including but not limited to:
   1. Automatic sprinkler systems.
   2. Fire department connections (FDC) and Siamese inlets.
   3. Special hazard suppression systems.
   4. Firestopping of all penetrations in rated walls, floors, and ceilings.

B. Related Systems Coordination:
   1. Fire alarm and detection devices for supervisory and flow-switch integration.
   2. HVAC, plumbing, and electrical penetrations for sleeves, insulation, and power wiring.

C. Compliance Requirements:
   1. Install and test all systems in strict accordance with the applicable editions of the NFPA, IBC/IFC, and local amendments.
   2. Where local codes are more stringent, the local requirements shall govern.

D. Exclusions:
   1. Work specifically indicated to be furnished under Division 1 “Alternate” scopes or by other trades.

E. Closeout:
   1. Provide as-built drawings, O&M manuals, test certificates, and third-party inspection reports.

1.2 DEFINITIONS

A. AHJ (Authority Having Jurisdiction): The organization, office, or individual responsible for approving equipment, materials, and procedures and enforcing the code (e.g., Fire Marshal).

B. Automatic Sprinkler System: A network of piping and sprinkler heads that discharges water automatically when a heat-sensing element actuates.

C. Wet-Pipe System: A sprinkler system in which the supply piping is maintained full of water at all times.

D. Fire Department Connection (FDC): A paired inlet (or Siamese) allowing the fire service to pump supplemental water into the sprinkler or standpipe system.

E. Firestop: Materials and assemblies used to restore the fire-rating of walls, floors, and ceilings penetrated by piping or ducts.

F. NFPA: National Fire Protection Association. All NFPA documents referenced are the editions indicated in Section 1.6.

G. IBC: International Building Code.

H. IFC: International Fire Code.

1.3 APPLICABLE CODES AND STANDARDS

A. International Codes
   1. IBC – International Building Code, 2021 Edition.

2. IFC – International Fire Code, 2021 Edition.
3. NFPA 101 – Life Safety Code, 2021 Edition.

B. Sprinkler, Standpipe & Pump Standards
1. NFPA 13 – Installation of Sprinkler Systems, 2021 Edition.
2. NFPA 25 – Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2020 Edition.

C. Fire Alarm & Detection
1. NFPA 72 – National Fire Alarm and Signaling Code.
2. UL 864 – Control Units and Accessories for Fire Alarm Systems, Latest Edition.
3. UL 268 – Smoke Detectors for Fire Alarm Systems, Latest Edition.

D. Firestop & Material Tests
1. UL 1479 / ASTM E814 – Fire Tests of Through-Penetration Fire Stops, Latest Edition.
2. ASTM E84 – Surface Burning Characteristics of Building Materials, Latest Edition.
3. ASTM E119 – Fire Tests of Building Construction and Materials, Latest Edition.

E. Auxiliary Standards
1. NFPA 70 – National Electrical Code, (for fire-pump power and alarm wiring).
2. NFPA 291 – Flow Testing of Fire Protection Systems, Latest Edition.
3. NFPA 101A – Guide on Alternative Approaches to Life Safety, Latest Edition.

F. Division References
1. Division 01 – General Requirements.
2. Division 21 – Fire Protection Piping and Special Hazard Systems.
3. Division 22 – Plumbing.
4. Division 23 – HVAC.
5. Division 26 – Electrical.

1.4 REGULATORY REQUIREMENTS

A. Permits, Licenses & Fees
1. Obtain and pay for all required permits, licenses, and inspection fees for fire-protection work.
2. Secure any special operating permits required by the AHJ.
3. Provide proof of permit issuance and fee payment before beginning work.

B. Inspections & Witness Testing
1. Coordinate and schedule all rough-in and final inspections with the AHJ's Fire Marshal or designated inspector.
2. AHJ witnessing is mandatory for:
   a. Sprinkler hydrostatic tests (per NFPA 13).
3. Record inspection dates, inspector names, and any required remedial actions; submit to the Engineer immediately.

C. Shutdown & Impairment Procedures
1. For any planned system shutdown or impairment, submit a written notification to the Owner and AHJ at least five (5) calendar days in advance.
2. Provide AHJ-approved temporary measures for the duration of the impairment.
3. Do not proceed with shutdown until receiving written owner and AHJ approval.

D. Certificates & Close-Out
1. After each inspection or test, obtain signed certificates of compliance from the AHJ and include them in the project close-out submittals.

2. Provide final third-party inspection reports, NFPA 25 inspection records, and proof of permit closure in the O&M manual.

E. Local Code Precedence
1. Where local or state code requirements adopted by the AHJ are more stringent than NFPA or IFC standards, the local requirements shall govern.

F. Continued System Availability
1. Maintain power, supervisory signaling, and sprinkler system integrity until final occupancy approval is granted by the AHJ.
2. Immediately restore any impaired systems at the end of each workday unless a written extension is granted by the AHJ.

1.5 PRODUCT REQUIREMENTS

A. Basis of Design:
1. Basis-of-design manufacturer for all fire-protection equipment (sprinklers, valves, etc.) shall be Victaulic / Tyco / Viking.
2. All items of similar equipment shall be products of the same manufacturer to ensure compatibility and simplified service.

B. Substitutions:
1. Comply with Division 01 Section “Product Requirements” for substitution procedures.
2. Contractor’s bid may be based on any manufacturers named; if bidding on “or-equal” products not listed, assume all coordination impacts and no added cost to Owner.
3. Where basis-of-design equipment dictates space, Contractor is responsible to verify “or-equal” equipment fits with required service clearances (maintenance and code). Submission of shop drawings constitutes that verification.
4. Electrical characteristics of listed equipment have been coordinated with Division 26; if substituted equipment has different voltage/amps, Contractor shall revise wiring, breakers, disconnects, and panel schedules at no cost to Owner. Written proof of coordination with the Electrical contractor must accompany the equipment submittal.
5. All substitution requests must be submitted in writing to the Architect at least 10 days prior to bid, including:
    a. Manufacturer, catalog, and model number of proposed substitute.
    b. Performance and dimensional data for comparison.
    c. Any required changes to other work.
    d. The burden of proof for “or-equal” compliance rests with the proposer; the Architect’s decision is final.

C. Value Engineering / Analysis (VE/VA):
1. If VE/VA is performed, Contractor shall notify all affected trades of any proposed product changes and include coordination impacts in their bids.
2. Contractor assumes responsibility for verifying that VE/VA offerings fit allocated spaces and meet maintenance/access requirements; shop drawings for VE/VA products imply such review.
3. Architect’s approval of VE/VA proposals is final; proof of merit rests with proposer.

D. Single Source Responsibility:
1. Where multiple devices form a system, furnish them from a single manufacturer to ensure matched performance and warranty.
2. Provide a manufacturer’s certification stating all supplied components are compatible and covered under a single warranty.

E. Coordination with Other Divisions:

1. Division 26 – verify electrical characteristics for pump motors, valve actuators, and alarm panels.
2. Division 23 – confirm HVAC/damper penetrations do not conflict with sprinkler piping layout.
3. Division 28 – ensure fire-alarm waterflow and supervisory switches match panel inputs.

1.6 SUBMITTALS

A. Division 01 Procedures:
1. Submit all submittals in accordance with Division 01 Section "Submittal Procedures." Use the project's digital platform and BIM Execution Plan naming conventions.

B. Hydraulic Calculations & Shop Drawings:
1. Fire-sprinkler hydraulic calculations and sprinkler shop drawings shall be prepared under the direction of a Professional Engineer licensed in the State of Alabama.
2. The Engineer shall sign and seal each drawing sheet and the cover sheet for the calculations, per the State Board of Professional Engineers and Land Surveyors and the State Fire Marshal requirements.

C. Product Data:
1. Submit a complete list of materials and equipment for all Division 21, Section 210450 fire-protection systems, including: manufacturer name, catalog/model number, dimensions, ratings, capacities, options, and applicable standards.
2. Highlight any deviations from the basis-of-design products.
3. Include performance curves for all pumps.
4. Do not place final equipment orders until submittals are returned as "No Exceptions Noted" or "Make Corrections Noted."
5. Submit electronically as PDF (exported—not scanned) files, one file per Section:
   a. Initial submittal to include an index of each equipment type.
   b. Subsequent submittals grouped by specification section; do not combine across sections.

D. Shop Drawings:
1. Before commencing work, submit detailed shop drawings (1/4″ = 1′-0″ scale) in PDF format showing:
   a. Fire-protection piping layouts, riser diagrams, fire-pump room plans, FDC locations, and valve/access door details.
   b. Structural penetration sleeve layouts for multi-story buildings (per Division 21 "Basic Fire Protection Materials and Methods").
2. Include elevations, clearances to ductwork and lighting, hanger/support details, and coordination notes with other trades.
3. Ensure submittals reference the latest approved contract drawings; failure to submit shop drawings will void responsibility protections for fit-up and piping conflicts.

1.7 COORDINATION DRAWINGS

A. General
1. Within 60 days of Notice to Proceed, submit Coordination Drawings covering all fire-protection work zones.
2. Coordination Drawings are purely for clash detection and will not be returned; the Architect will review for conflicts and notify the Contractor.
3. Do not base Coordination Drawings on simple reproductions of Contract Documents or catalog data.

B. Content
1. Draw project-specific information, accurately to scale, showing:

a. Spatial relationships and sequencing fire-protection elements in plenums, shafts, and finished spaces.
b. Critical dimensions from Contract Drawings and any conflicts with equipment clearances or architectural finishes.

2. Flag any conflicts or clearance issues and provide alternate sketches for resolution. Minor dimensional adjustments (≤ 1 in.) that do not affect system performance or code compliance are not considered Contract changes.

C. Format
1. Plan and reflected-ceiling views at a scale no smaller than 1/4″ = 1′-0″; include sections through congested areas for vertical-clearance verification.
2. Submit electronic files in native AutoCAD .dwg format (one discipline per file) and PDF prints.
3. Use a discipline-unique layering system separate from base wall/ceiling outlines.
4. Base CAD files and model sections will be provided by the Architect.

D. Shop-Drawing Database Workflow
1. Phase 1 – HVAC: HVAC subcontractor establishes the database with all ductwork, piping, equipment, floor drains, and motor electrical stub-ups.
2. Phase 2 – Plumbing: Plumbing subcontractor imports the HVAC database, adds all plumbing piping, controls, valves, and fixtures, then forwards to Fire Protection.
3. Phase 3 – Fire Protection: Fire Protection subcontractor imports the combined database, adds all fire-protection piping, sprinkler heads, valves, FDCs, and access panels, then forwards to Electrical.
4. Phase 4 – Electrical: Electrical subcontractor imports the full database, adds all conduits, fire-pump power, alarm wiring, and devices, then delivers to the General Contractor.

E. Final Coordination & Submission
1. General Contractor reviews the fully assembled coordination drawings, resolves all interdisciplinary conflicts in consultation with the Architect and subcontractors, and incorporates any remaining building elements.
2. Submit three (3) hard-copy sets and one complete electronic package (PDF and .dwg) of the final, coordinated shop drawings to the Architect on CD/USB.
3. The Architect will not review or process any trade shop drawings (including fire-protection) until the coordination drawings are approved floor-by-floor at a minimum.

1.8 QUALITY ASSURANCE

A. Installer Qualifications
1. Shall have a minimum of 3 years' documented experience installing fire-protection systems of similar size and complexity.
2. Shall have successfully completed at least 5 comparable projects within the last 5 years.
3. Installer personnel performing installation of systems shall be factory-trained and authorized by the respective equipment manufacturers.
4. A Professional Engineer, licensed in the State of Alabama, shall be responsible for reviewing and stamping all sprinkler shop drawings and hydraulic calculations.

B. Third-Party Inspection Agency
1. Engage a third-party inspection agency certified to NICET Level III (or higher) in water-based fire-protection inspection, or an AHJ-approved equivalent.
2. Submit signed inspection reports and certificates directly to the Engineer and Owner.

C. Manufacturer Field Service
1. Manufacturer's representative shall perform a minimum of two (2) on-site visits.

a. Rough-in inspection to verify correct installation of piping, hangers, and valve orientation.
b. Pre-commissioning review to confirm equipment set-up, clearances, and control wiring.

2. Provide a letter from the manufacturer confirming each field visit and noting any deviations or corrective actions.

D. Code Compliance
1. Installer shall comply with all applicable NFPA standards (NFPA 13, 14, 20, 25), IBC/IFC requirements, and local amendments adopted by the AHJ.
2. Equipment and materials shall be UL-listed or FM-approved for their intended use.

E. Training
1. Provide operation-and-maintenance training for Owner's personnel.
2. Deliver training documentation, attendance roster, and "hands-on" verification forms as part of close-out submittals.

1.9 DRAWING INTERPRETATION AND COORDINATION

A. General Intent
1. Contract Drawings indicate size, capacity, location, direction, and overall relationship of fire-protection systems. They do not show exact field dimensions or final routing.

B. Dimension Verification
1. Do not scale drawings to determine location of piping, hangers, or equipment.
2. Field-verify all dimensions and clearances against:
a. Architectural plans (ceiling grids, light fixtures, diffuser locations)
b. Structural elements (beams, columns, slabs)
c. MEP drawings (ductwork, plumbing, electrical)
d. Actual site conditions

C. Field Adjustments
1. Make minor field adjustments to piping routes, sprinkler-head locations, and access panels to optimize:
a. Ease of service and maintenance
b. System performance and flow characteristics
c. Aesthetic alignment with ceiling finishes and architectural features

D. Conflict Resolution & Clarifications
1. If discrepancies or ambiguities arise between drawings, specifications, or field conditions, submit a Request for Information (RFI) and obtain written clarification from the Architect/Engineer before proceeding.
2. Proceeding without written clarification transfers responsibility for any resulting conflicts or corrective work to the Contractor.

E. Reference to Architectural Drawings
1. Use architectural reflected-ceiling plans as the master reference for sprinkler-head and trim-plate centering around ceiling fixtures and grids.
2. Coordinate final head locations and escutcheon types with ceiling-finish conditions.

1.10 PROJECT / SITE CONDITIONS

A. Site Investigation
1. Prior to bidding, and again before starting work, visit the site to become fully familiar with existing conditions that may affect the fire-protection work, including access, clearances, and existing utilities.

2. No additional compensation will be allowed for work impeded by conditions that a reasonable site visit would have revealed.

B. Utility Verification
1. Locate, verify, and record sizes, inverts, and routes of all existing and proposed utilities affecting fire-protection systems.
2. Confirm fire pump suction and discharge connections are compatible with existing piping.
3. Update shop drawings and hydraulic calculations if utility conditions differ from contract documents.

C. Interference and Shutdown Coordination
1. Sequence work to minimize interruption of existing services. Any shutdown of fire-water, domestic water, or related utilities requires:
   a. Written approval from the Owner and AHJ at least five (5) days in advance.
   b. Provision of temporary services (portable pumps, standpipes, fire watches) as directed by the AHJ.
2. Coordinate shutdowns and outages with all affected trades—electrical, plumbing, HVAC, and structural—to avoid conflicts.

D. Protection of Existing Conditions
1. Protect existing site improvements, paving, landscaping, structures, and utilities from damage during fire-protection work.
2. Repair any damage to existing improvements at no cost to the Owner.
3. Maintain clean, safe work areas and remove debris daily.

E. Unforeseen Conditions
1. If concealed or unknown conditions are encountered that differ materially from contract documents, immediately notify the Engineer in writing before proceeding.
2. Obtain written instructions from the Engineer to address these conditions; do not proceed at Contractor's risk.

1.11 SUBMITTALS FOR PROJECT CLOSEOUT

A. On-Site Record Prints
1. Keep one set of prints on-site, updated daily with all corrections, variations, deviations, and Change-Order work to the fire-protection drawings.
2. Accurately show actual location, size, and elevation of all new exterior and interior fire-protection elements, dimensioned from permanent building features.
3. Record changes on the prints each day.
4. Before requesting final payment, submit the marked-up prints to the Architect for review.
5. Contractor shall prepare complete as-built record drawings reflecting all field-verified changes and submit them to the Engineer for review and approval.

B. Record Drawings & Closeout Data
1. Record Drawings: Provide PDF reproducibles and native AutoCAD (.dwg) files for all fire-protection piping and equipment layouts.
2. Equipment Submittal Data: Two (2) complete sets of final product data submittals (as-built configurations).
3. Operation & Maintenance Manuals: Two (2) complete O&M manuals covering all fire-protection equipment.
4. Warranties & Guarantees: Two (2) copies of all equipment warranty certificates and guarantees.
5. Training Roster: List of Owner's personnel who have received system operation and maintenance instruction.

C. Final Submission for Approval
   1. Prior to issuance of the Certificate of Final Payment, submit the following to the Architect for approval:

D. Material & Test Certificates
   1. Contractor's certified Material and Test Certificate for above-ground fire-protection piping.

E. Underground Piping Certificate
   1. Contractor's certified Material and Test Certificate for underground fire-protection mains.

PART 2 - PRODUCTS – Not Used.

PART 3 - EXECUTION – Not Used.

END SECTION 21 0451

SECTION 21 0452

IDENTIFICATION FOR FIRE PROTECTION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, including color and letter style.

1.3 QUALITY ASSURANCE

A. NFPA Compliance: Comply with applicable NFPA standards regarding labeling and signage for fire protection systems.

B. ASME Compliance: Pipe identification colors and labeling shall comply with ANSI/ASME A13.1.

1.4 COORDINATION

A. Coordinate installation of identification devices with completion of covering and painting of surfaces where devices are applied.

B. Coordinate installation with access panel and door locations.

C. Install identification prior to installation of acoustical ceilings and concealment.

D. In existing buildings, match existing labeling standards and methodology unless otherwise directed by the Architect.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Material: Multilayer, multicolor, mechanically engraved plastic, 1/16-inch thick, with predrilled holes or adhesive backing.

B. Color Coding: Red background with white letters for fire-protection equipment.

C. Minimum Size: 2-1/2 by 3/4 inch.

D. Minimum Letter Height: 1/2 inch.

E. Fasteners/Adhesives: Stainless-steel screws or permanent contact-type adhesive.

F. Content: Equipment designation or unique equipment number.

G. In existing buildings, match existing label format and numbering.

2.2 WARNING SIGNS AND LABELS

A. Material: Engraved plastic, 1/16-inch thick.

B. Color: Yellow background with white letters.

C. Size: Not less than 2-1/2 by 3/4 inch.

D. Letter Height: Minimum 1/2 inch (scaled for visibility).

E. Mounting: Stainless-steel fasteners or permanent adhesive.

F. Content: Caution and warning messages as indicated on the Drawings or Specifications.

2.3 PIPE LABELS

A. General: Preprinted, color-coded, with service lettering and flow direction.

B. Color Standards: Comply with ANSI/ASME A13.1 unless otherwise indicated.

C. Label Type: Snap-on semi-rigid plastic for pipes ≤ 6 in. diameter; strap-on type for larger pipes.

D. Content: Service identification and integral or separate directional arrows.

E. Lettering Height: Minimum 1-1/4 in. for pipe 2-1/2 in. and larger.

F. In existing buildings, match existing labeling format and color scheme.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean all surfaces of dirt, grease, paint, or other substances before applying labels or tags.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install permanent labels on all major fire-protection equipment and starters furnished under this Division. Labels shall be accessible and clearly visible.

3.3 WARNING-SIGNS AND LABELS INSTALLATION

A. Install warning signs and labels on equipment and system components as indicated.

3.4 PIPE LABEL INSTALLATION

A. Label fire-protection mains and associated piping in accordance with ASME A13.1.

B. Locate labels at the following:
1. At each valve and control device.
2. At branch connections.
3. At wall, floor, or ceiling penetrations.
4. At changes in direction.
5. At access points (doors, manholes, tunnels).
6. At equipment connections and system terminations.
7. At intervals not exceeding 20 feet on exposed piping runs.

END OF SECTION 21 0452

SECTION 21 0453

BASIC FIRE PROTECTION MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes common materials, accessories, and general installation requirements for fire-protection systems, including:
1. Piping materials and joining methods common to fire-protection systems.
2. Mechanical sleeve seals.
3. Sleeves and penetrations.
4. Concrete and grout.
5. Escutcheons.
6. Building access doors.
7. Flashing.
8. Workmanship.
9. Cutting and patching.
10. Excavation, trenching, and backfilling.
11. Piping systems installation – common requirements.
12. Equipment installation – common requirements.
13. Painting and finishing.
14. Supports and anchorages.
15. Protection and cleaning of equipment and materials.

1.2 DEFINITIONS

A. Finished Spaces: Occupied, architectural spaces.

B. Exposed, Interior Installations: Visible in occupied interiors and mechanical/electrical rooms.

C. Exposed, Exterior Installations: Visible outdoors, subject to weather.

D. Concealed, Interior Installations: Above ceilings, in chases, or concealed from view.

E. Concealed, Exterior Installations: Concealed from view but subject to ambient outdoor temperatures.

F. Abbreviations:
1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

1.3 SUBMITTALS

A. Product Data: For sleeve seals, escutcheons, access doors, and accessories.

B. Informational Submittals: Sleeve drawings for multi-story buildings indicating size, location, and pipe service.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes with factory end caps; maintain caps until installation.

B. Store plastic pipe protected from sunlight; support to prevent sagging.

1.5 COORDINATION

A. Coordinate chases, sleeves, and openings with structure and other trades.

B. Coordinate building access doors with concealed valves and devices.

C. Coordinate final electrical characteristics of fire-protection equipment with Division 26 before ordering equipment.

PART 2 - PRODUCTS

2.1 PIPE, TUBE AND FITTINGS

A. Refer to individual Division 21 piping sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe.

2.2 JOINING MATERIALS

A. Flange gaskets: ASME B16.21 or AWWA C110, asbestos-free, appropriate to service.

B. Bolts/Nuts: ASME B18.2.1, carbon steel unless noted otherwise.

C. Solder/Brazing filler metals: Lead-free per ASTM B32 / AWS A5.8.

D. Solvent cements: ASTM D2564 (PVC), ASTM F493 (CPVC); VOC limits per LEED requirements when applicable.

2.3 MECHANICAL SLEEVE SEALS

A. Modular interlocking sealing elements with pressure plates and bolts, EPDM or equivalent.

B. Provide U.L. fire-rated assemblies at fire-rated wall penetrations.

C. Manufacturers: Calpico, APS Innerlynx, Link-Seal, Metraflex, Pipeline Seal & Insulator.

2.4 SLEEVES

A. Galvanized sheet-metal sleeves for partitions.

B. Schedule 40 steel pipe sleeves for structural concrete.

C. Firestopping sealants: Refer to Division 07.

D. Stuffing insulation: Non-combustible glass fiber.

2.5 CONCRETE AND GROUT

A. Concrete: 3000 psi min. compressive strength.

B. Grout: ASTM C1107, non-shrink, non-metallic, 5000 psi design strength.

2.6 ESCUTCHEONS

A. Chrome-plated manufactured wall, ceiling, and floor plates sized to cover annular space around piping.

2.7 ACCESS DOORS – BUILDING

A. 14-gauge steel doors with 16-gauge steel frames, concealed hinge, screwdriver cam latch, prime coated.

B. Fire-rated where installed in rated construction.

C. Manufacturers: Bilco, Milcor, Nystrom.

2.8 FLASHING

A. Flexible sheet butyl flashing, 47 mil thick.

B. Lead sheet, 5 lb/SF for waterproofing.

C. Pitch cups: 20-gauge galvanized steel.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. First class and in accordance with best practice. Work to be orderly, neat, workmanlike in appearance and performed by skilled craftsman.

B. Poor or improper workmanship shall be removed and replaced as directed by the Architect without additional cost to the Owner or design professionals.

3.2 CUTTING AND PATCHING

A. Comply with the requirements of other Divisions for the cutting and patching required to accommodate the installation of Fire Protection work. Repair and finish to match surrounding.

B. Architect's approval required before cutting any part where strength, or appearance of finished work is involved.

C. Openings are to be laid out and built-in, set sleeves and inserts and furnish detailed layout drawings to other trades in advance of their work.

D. Core drill or saw cut openings in existing masonry construction.

3.3 EXCAVATION, TRENCHING AND BACKFILLING

A. Perform excavation/backfill per Division 31 "Earthwork."

B. Provide 6 in. bedding below piping; backfill with sand/fine gravel.

C. Compact to 95% density under pavements; restore surfaces to match existing.

3.4 PIPING SYSTEMS INSTALLATION - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 21 Fire Protection Piping Sections specifying piping systems.

B. Drawings, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas and stairwells.

D. Install piping indicated to be exposed and in service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections. No mitering or notching for fittings permitted.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install escutcheons where exposed piping penetrates walls, ceilings, and floors in finished spaces.

3.5 SLEEVES

A. Sleeves are not required for core-drilled holes.

1. In mechanical room floors and other potentially wet areas, provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
   1. Cut sleeves to length so that sleeve extends out ½ inch from both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas, or other potentially wet areas, 1-1/2 inches above finished floor level. Caulk space outside of sleeves water tight.
   2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
   3. Use the following sleeve materials:
      a. Sleeves for Piping Through Concrete Beams, Concrete Walls, Footings, and Potentially Wet Floors: Steel pipe.
      b. Sleeves for Piping Through Masonry Walls and Gypsum Board Partitions: 22 gauge galvanized sheet metal sleeves 1/2 inch larger than pipe or pipe covering.
   4. Where piping penetrates non-rated equipment room wall, floors or roofs outside of a shaft, close off space between pipe and adjacent work with stuffing insulation and caulk air tight.
   5. Above ground, non-rated, exterior wall penetrations: Seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
   6. Seal space around the outside of sleeves with grout at masonry walls and floors and dry wall mud at gypsum board partitions.

C. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
   2. Fill void between pipe and sleeve with urethane foam and water proof around pipe on below grade end.

D. Fire-Rated Penetrations: Where pipes pass through fire-rated and fire-resistive floors, walls, and partitions, install appropriately rated sleeves and firestopping sealant. Firestopping materials and installation methods are specified in Division 07 Sections “Through Penetration Firestop Systems” and “Fire Resistive Joint Systems”.

3.6 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 21 Fire Protection Piping Sections specifying piping systems.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

D. Flanged Joints:
   1. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.

3.7 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 PIPE CLEANING

A. Keep pipe clean and free of dirt. Keep caps on ends of pipe when it is stored on site and reinstall caps on ends of installed piping at the end of each day.

3.9 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

D. Install equipment in accordance with manufacturer's instructions. If manufacturer's instructions conflict with Contract Documents, obtain Architect's decision before proceeding.

E. Install equipment to allow right of way for piping installed at a required slope.

F. All equipment shall be firmly fastened in place:
   1. Pad mounted equipment shall be secured to pads using poured in place anchor bolts or cinch anchors.
   2. Vibration isolators shall be secured to floors or pads and equipment shall be bolted to the isolators.

3.10 PAINTING AND FINISHING

A. Except as specified below or noted on the Drawing, requirements for painting of Fire Protection systems, equipment, and components are specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.11 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" requirements.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing and fire protection materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.12 GROUTING

A. Mix and install grout for Fire Protection equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.13 ACCESS DOORS – BUILDING

A. Provide access doors in wall and inaccessible ceilings to allow access to service and maintain concealed equipment, valves, etc.

B. Coordinate installation of access doors with Divisions responsible for Building System in which panels are being installed.

3.14 FLASHING

A. Provide flexible flashing and metal counterflashing where pitch cups and piping penetrate weather or waterproofed walls, floors and roofs.

3.15 PROTECTION AND CLEANING OF EQUIPMENT, FIXTURES, AND MATERIALS

A. Protect equipment and piping from weather, dust, and damage during construction.

B. Keep pipe ends capped until final installation.

C. Clean all exposed materials and equipment prior to turnover.

END SECTION 21 0453

SECTION 21 0455

FIRE PROTECTION SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fire protection system(s) including design-assist, materials, shop drawings, installation, identification, controls/interfaces, acceptance testing, certification, training, and closeout for the following where shown:
   1. Underground fire service and in-building riser.
   2. Wet-pipe sprinkler systems.

1.2 RELATED SECTIONS

A. Section 210451 – General Fire Protection Requirements.

B. Section 210452 – Identification for Fire Protection Piping and Equipment.

C. Section 210453 – Basic Fire Protection Materials and Methods.

1.3 CODES, LISTINGS, & AUTHORITY HAVING JURISDICTION (AHJ)

A. Comply with AHJ-adopted editions of NFPA 13/14/20/24/25, NFPA 72, and (clean agent) NFPA 2001; compressed gas cylinders per NFPA 55; electrical per NFPA 70.

B. All system components shall be UL Listed and/or FM Approved (where required) for the intended service, installed per their listings.

C. Jurisdiction Note: This specification defaults to City of Dothan, Alabama practices.

1.4 PERFORMANCE & DESIGN BASIS

A. Hydraulic Method (Sprinklers): Area/Density unless otherwise indicated by design drawings. Include hose allowance.

B. Default Remote Area & Density:
   1. Light Hazard (offices, patient rooms, corridors): 0.10 gpm/sf at 1,500 sf + 100 gpm hose.
   2. Ordinary Hazard Group 1 (small mech./elec ≤250 sf, kitchens without hoods): 0.15 gpm/sf @ 1,500 sf + 250 gpm hose.
   3. Ordinary Hazard Group 2 (loading, larger elec/mech, storage <12 ft): 0.20 gpm/sf @ 1,500 sf + 250 gpm hose.
   4. Storage >12 ft: Design per commodity/arrangement.

C. Supply Margin: Peak system demand (incl. hose) ≥ 10% below the available supply curve used for design.

D. Freezing Conditions: Use dry/preaction or listed heat-trace and insulation.

1.5 SYSTEM TYPE

A. New Construction: Provide a complete, new **wet** system throughout the **building**, fully compliant with NFPA as applicable and the AHJ's adopted editions.

1.6 SUBMITTALS FOR REVIEW

A. Product Data: Submit to the Architect and obtain his approval of a complete list of materials and equipment which are to be furnished under Division 21.
   1. List shall be complete with manufacturer's names, catalog number, dimensions, specifications, rating data and options utilized. Capacities shall be in the terms specified.

2. Call attention to deviations from specified items as to operation and physical dimensions.
3. Grooved joint couplings and fittings may be shown on drawings and product submittals, and shall be specifically identified by the manufacturer's style or series designation.
4. Performance curves for equipment such as pumps shall be included.
5. Final equipment orders shall not be placed until submittals have been returned marked "No Exceptions Noted" or "Make Corrections Noted".
6. Bind all equipment submittals and provide index tab for each type of equipment. Submit all at one time. Reserve two sets for project close-out documents.

B. Shop Drawings:
1. A reflected ceiling plan indicating locations of sprinkler heads, lights, HVAC devices, smoke detectors, exit lights and any additional items attached to ceiling. In lift out ceilings, sprinkler heads are to be centered in ceiling tiles. In hard ceilings, sprinkler heads to follow the general arrangement of the ceiling. After review by the Architect, revise layout as required.
2. Prepare a working pipe shop drawing based on hydraulic calculations. The piping shop drawing shall indicate routing and configuration of piping, size of pipe, piping support, elevation of piping and coordination of piping with ductwork. Shop drawings shall include low point drain downs.
3. Hydraulic calculations are to be prepared utilizing a current water flow test (maximum 90 days old). If current flow test is not available, obtain a current flow test and pay for all fees required.
4. Sprinklers shall be referred to on drawings and other documentation by the manufacturer's model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations are not permitted.
5. Sprinkler head schedule shall clearly indicate the temperature rating of each sprinkler type to be provided. Submittals that do not include temperature rating data for each head will be considered incomplete.
6. If water flow information is not available due to new main extension or other construction which prohibits the availability of flow information at the start of construction, the contractor shall estimate probable flow information based on information available. Once permanent water is available at the site, the Contractor shall perform a flow test, incorporate the information into the calculation and make any modifications to the system as may be required.
7. When allowed by local and state authority having jurisdiction, calculations may be calculated from fire pump or standpipe given current flow data of pump and fire riser is provided. Fire pump and/or standpipe test to be within 1 year. A head replacement plan will not be accepted.
8. When drawings and hydraulic calculations are submitted to the Engineer for review, they shall bear the seals of review and approval of the Architect, General Contractor, the Owners Insurance Underwriter. Hydraulic calculations and sprinkler shop drawings for building fire protection systems must be prepared under the supervision of an engineer licensed in the State of Alabama and bear his/her licensure seal with signature and date.
9. The Contractor shall incorporate all comments for approval by local Fire Marshall's Office and any State of Alabama Reviewing Agency. Contractor shall provide signed, sealed and approved set of plans to Engineer upon approval by state and local authorities.
10. Each system calculations, components and alarming to be on shop drawings. Refer to following sections for Special Hazard Systems.

1.7 QUALITY ASSURANCE & COORDINATION

A. BIM/Coordination: Provide coordinated MEPFP models/drawings (1/4″=1′-0″ in congested zones). Show clearances, valve access, test/discharge routing, seismic sway spaces.

1.8 DELIVERY, STORAGE, HANDLING

A. Cap pipe ends; store sprinklers in cases until install; protect finishes; keep valves/devices dry/indoors.

1.9 EXTRA MATERIALS

A. Spare sprinklers/wrenches/cabinet per NFPA 13 (quantities by temp/finish).

B. Six (6) spare recessed and six (6) spare concealed escutcheons per type/finish.

C. Twelve (12) spare head guards (if used).

D. Two (2) sight-glass kits for test & drain assemblies.

PART 2 - PRODUCTS

2.1 PIPING BELOW GRADE AND BELOW SLAB ON GRADE

A. Pipe: Ductile Iron Class 50/51/52, cement-mortar lined (AWWA C151/C104), asphaltic exterior.

B. Fittings & Joints: Ductile iron mech. joint fittings; restrained joints/retainer glands as required; thrust blocks per calc/soil; locator tape and #10 AWG tracer wire continuous to In-building riser and fire department connection.

C. In-Building Riser: Fabricated elbow/riser fitting, listed, with CIPS/grooved ends; no field alteration. Where an in-building riser is not feasible, provide restrained ductile iron lead-in with wall sleeve/seal.
   1. Manufacturer:
      a. Ames IBR.

2.2 ABOVE GROUND PIPING

A. Wet Systems: ASTM A53/A795/A135 steel; Sch 10 roll-grooved or Sch 40 threaded/grooved; grooved per manufacturer.

B. CPVC: Not permitted unless explicitly noted; if used in tenant or special areas, pipe/fittings listed for FP, orange CPVC, compatible heads/adapters.

C. Joints: Threaded per ASME B1.20.1 with listed compound/tape; flanged per ASME B16.5 with listed gaskets; grooved per listing.

D. All piping shall be pitched to drain down at low points. Pipe all drains associated with low points to AHJ's preferred location. Coordinate drain locations with Architect.

2.3 SPRINKLERS, ESCUTCHEON, & FLEXIBLE DROPS

A. Sprinkler Heads (All sprinklers shall be UL/FM approved for the designed location and use):
   1. Quick Response Recessed Pendent, K-Factor 5.6, Chrome Finish.
      a. Manufacturers:
         1) Viking VK102. Reliable, Tyco, Globe, and Victaulic are approved equals
   2. Quick Response Concealed Pendent, K-Factor 5.6, White Finish.
      a. Manufacturers:
         1) Reliable G5. Viking, Tyco, Globe, and Victaulic are approved equals
   3. Upright, K-Factor 8.0, Bronze Finish with Head Guard.
      a. Manufacturers:
         1) Tyco TY-B. Viking, Reliable, Globe, and Victaulic are approved equals

B. Special Heads:
   1. MRI non-ferrous concealed pendent.
      a. Manufacturer:
         1) Reliable F4FR-NF. Adjust temperature as calculated.
   2. Window Sprinklers
      a. Manufacturer:
         1) Tyco Model WS, installed per listing/glass geometry.

3. Cleanroom/OR sealing heads.
    a. Manufacturer:
        1) Viking VK462.

C. Flexible Drops:
1. Braided stainless with listed bracket; include equivalent length in calcs; adhere to max bends/min radius; use seismic-rated kits where required. These flexible connections may be required for seismic, ease of installation, tenant flexibility, Owner, or specific sprinkler location requirements. The use of other UL/FM approved devices manufactured by other than Victaulic is not acceptable to achieve the seismic requirements for this project. Flexible sprinkler drops shall be installed in strict accordance to their listings as published by the manufacturer's instructions. Particular attention to the minimum radius of each bend as well as, the number of bends allowed installed in a single flexible drop. This shall be under close scrutiny during the installation process. Victaulic's representative shall periodically visit the job site and review installation. Each flexible drop not properly installed as determined by engineer or Victaulic shall be replaced by the Contractor at no additional cost to the Owner, General Contractor, or Engineer of Record.
    a. Manufacturer:
        1) Victaulic VIC-FLEX AH2

2.4 VALVES, DEVICES, ASSEMBLIES

A. Floor Control Assembly (each zone): Supervised OS&Y or supervised butterfly valve, check valve, waterflow switch to FA, and test & drain with sight glass/orifice.
1. Manufacturer:
    a. Victaulic TestMaster II Style 720 or Viking A-1.

B. Gate Valves:
1. Up to and including 2 Inches:
    a. Bronze body, bronze trim 175 psi WP, UL Listed, rising stem, handwheel, solid wedge or disc, threaded ends.
    b. Manufacturer:
        1) Nibco T-104-O. Victaulic, Watts, Tyco and Milwaukee are approved equals.
2. Over 2 Inches:
    a. OS&Y Iron body, bronze trim 175 psi WP, UL Listed, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid bronze or cast iron wedge, flanged or grooved ends.
    b. Manufacturer:
        1) Nibco F-607-OTS. Victaulic, Watts, Tyco and Milwaukee are approved equals

C. Butterfly Valves:
1. Cast or ductile iron, chrome or electroless-nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM pressure responsive seat, lug, or grooved ends, and stainless steel stem. (Stem shall be offset from the disc centerline to provided complete 360-degree circumferential seating.) Valve shall have an extended neck, handwheel and weatherproof actuator housing with gear drive and integral indicating device, and internal tamper switch rated, UL / FM approved.
    a. Manufacture:
        1) Nibco Model GD-4765-4/8. Victaulic, Watts, Tyco and Milwaukee are approved equals.

D. Check Valves:

1. Iron body and swing disc, bronze seat, stainless steel spring, grooved ends, 250 psi WP; suitable for vertical or horizontal installation.
    a. Manufacturer:
        1) Nibco Model G-917-W. Victaulic, Watts, Tyco and Milwaukee are approved equals

E. Alarm Check Valve:
1. Complete with retard chamber, drains, gages, by-passes and all accessories required to prevent accidental alarms due to fluctuations in system pressure and testing of the valve while in service. Provide both mechanical and electrical means for actuation of Fire Alarm. Pipe all drains full size to AHJ's preferred location. The alarm check valve's internal components shall be replaceable without removing the valve from the installed position.
    a. Manufacturer:
        1) Victaulic 751 grooved end valve / Viking J-1 flanged valve.

F. Water Motor Alarm:
1. Hydraulically operated impeller type alarm with aluminum alloy chrome plated gong and motor housing, nylon bearings, and inlet strainer.
    a. Manufacturer:
        1) Victaulic Series 760.

G. Fire Department Valve:
1. 2-1/2 Inch pressure regulating angle hose valve with cap and chain at locations where pressure exceeds 65 psi. Outlet threads shall match that of the local fire department.
    a. Manufacturer:
        1) Croker 5000 Series.

H. Fire Department Siamese Connection:
1. Chrome plated exposed with clappers, caps and chains.
    a. Manufacturer:
        1) Crocker Figure No. 6410-PC.
2. Location to be coordinate with Fire Chief and Architect.
3. At the low point near each fire department connection, install a 90-degree elbow with drain connection to allow for system drainage to prevent freezing. Basis of Design: Victaulic #10-DR.

2.5 RISER MANIFOLD

A. Working pressure is 175 PSI equipped with; water flow switch, ball valve, test and drain, valve with properly sized test orifice, and sight glass. Provide optional pressure relief valve for grid system installation.
1. Manufacturer:
    a. Tyco Model 513

2.6 HANGERS AND SUPPORTS

A. Pipe Hangers and Supports:
1. Conform to NFPA 13.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.

8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Plate Support: Carbon steel ring, adjustable, copper plated.
10. All hangers to be a maximum of 12 inches from all 90 deg ells, the end of a branch line and mains, or an arm-over for drop.

2.7 FIRE STOP SYSTEMS

A. All wall and floor penetrations are to be closed. Refer to the Arch. Life Safety Plans and close all openings with a U.L. listed assembly compatible with the rating of the wall or floor being penetrated.

B. Non-rated walls – sheet rock joint compound may be used to seal opening.

C. For piping passing through listed sheet rock walls or partitions:
1. Uninsulated pipe passing through 2 hour walls or partitions – minimum 5/8" depth of Hilti FS 605 filling annular space between wall and pipe on both sides of wall. U.L. Listing #WL1056.
2. Uninsulated pipe passing through 2 hour walls or partitions – minimum 1-1/4" depth of Hilti FS 601 filling annular space between pipe and wall on both sides of wall, U.L. Listing #WL1054.

D. For piping passing through concrete floors, concrete walls or concrete block walls.
1. Uninsulated Schedule 40 steel pipe; fill annular space between pipe and opening with Hilti #FS 605. U.L. Listing #CJ1184.

PART 3 - EXECUTION

3.1 PREPARATION

A. Codes & Standards
1. Install fire protection piping in accordance with the AHJ-adopted editions of: NFPA 13 (sprinkler), and NFPA 24 (private service mains).
2. Where requirements conflict, the most stringent governs unless directed otherwise by the AHJ.

B. Utility Interface
1. Connection to Site Fire Service: Coordinate and connect to the site fire service installed under other sections. Verify size, material, elevation, and location against the Civil drawings before starting work.

C. Piping Layout & General Installation
1. Route piping neatly, plumb, and parallel/perpendicular to structure; conserve space and maintain required slopes/gradients.
2. Group piping at common elevations where practical.
3. Provide flexibility and guides so thermal movement does not stress pipe, joints, or connected equipment.
4. Install to maintain service access to valves, devices, and equipment.

D. Grooved Piping
1. Install grooved joints per coupling manufacturer's written instructions.
2. Pipe ends shall be clean, square, and free of indentations/roll marks.
3. Use listed gaskets suitable for the service; gaskets shall be by the coupling manufacturer.
4. Provide manufacturer-authorized on-site training for field crews on grooving/installation. Manufacturer's technical representative shall make periodic quality visits. *(Distributor-only reps are not acceptable for training.)*

E. Inserts, Hangers, and Supports
1. Inserts:

a. Provide embeds/inserts in new concrete for future supports; coordinate locations prior to placement.
b. For pipes >4 in., provide hooked rods or equivalent reinforcement as required.
c. Where slabs are exposed ceilings, set inserts flush with the finished surface.

2. Hangers/Supports:
a. Design, locate, and install per NFPA 13 / NFPA 14 and the hanger manufacturer's listings.
b. Support vertical risers at each floor and independently of horizontal branches.
c. Multiple parallel pipes may use trapeze hangers where permitted.
d. Provide compatible hangers for copper or CPVC where used (no dissimilar-metal corrosion).
e. Finish of hangers/supports per Division 05/09; components in concealed interstitial spaces are not considered "exposed" for painting.

F. Drainage & Low Points
1. Slope mains 0.25 in. per 10 ft minimum and branches 0.50 in. per 10 ft minimum, unless otherwise required (e.g., refrigerated spaces 0.50 in. per 10 ft for all).
2. Arrange systems to drain at low points and provide auxiliary drains (drum drips) where required.
3. Penetrations, Sleeves, and Firestopping
4. Do not penetrate structural members unless indicated.
5. Provide sleeves at floor/wall penetrations; size to maintain clearances/insulation.
6. Firestop penetrations to the fire-resistance rating of the assembly using listed systems (see Division 07).
7. Seal non-rated penetrations airtight and watertight where exposed to weather or wet areas.

G. Surface Preparation & Touch-Up
1. Prepare pipe, fittings, supports, and accessories for finishes per Division 09.
2. Where support members are field-welded to building steel, clean and apply one coat zinc-rich primer to welds.

H. Joints, Valves, and Appurtenances
1. Threaded joints: cut NPT taper threads; clean and apply PTFE tape or PTFE compound to male threads only.
2. Install valves with stems upright or horizontal (not inverted) and provide shut-off/isolation where indicated and at logical sectional points.
3. Provide drain valves at main shut-offs, low points, and equipment as required.

I. Material Compatibility
1. When multiple piping materials are used, provide listed transition fittings and ensure full system compatibility.
2. Provide flanges/unions/couplings at equipment to facilitate service.

J. Attic/Unconditioned Spaces
1. Where piping is installed in attics or other freezing environments, provide dry/preaction solutions only as permitted by NFPA 13 and the AHJ.
2. If insulation is used to mitigate freezing, do not allow insulation to bear on piping; maintain clearances per listing/manufacturer.

K. Sprinkler Devices – Handling & Selection
1. Do not install any sprinkler that is dropped, damaged, shows fluid loss, or has a cracked bulb.
2. Remove protective caps/guards by hand only.

3. Response Type: Provide quick response sprinklers for Light Hazard and Ordinary Hazard areas unless plans/code indicate otherwise.
4. Finishes: Sprinklers in finished ceilings/walls: chrome with matching recessed escutcheons unless otherwise noted.
5. Shell/Spec Suites: Where “sprig-ups” are not used, provide minimum 1″ outlets with hex bushings at branch lines to accommodate future modifications.
6. Temperature Ratings: Select per NFPA 13 tables based on proximity to heat sources. Do not up-rate sprinklers generically unless specifically required by NFPA 13 or the AHJ.
7. Ceiling Coordination: In 2′×2′ and 2′×4′ ACT ceilings, center sprinklers in the tile. (Flexible drops/return bends as needed.) Exceptions: toilets, janitor closets, storage rooms, and kitchens—locate ≥6 in. from tee bars.

L. Protection of Installed Sprinklers
1. Prior to substantial completion or Owner occupancy (whichever is later), protect installed sprinklers from overspray, dust, and airborne contaminants from construction (texture, sealers, primers, paints, etc.). Remove protection only when risk has passed.

END OF SECTION 21 0455

SECTION 22 0401

GENERAL PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general plumbing requirements. Applies to all Division 220400 sections.

1.2 DEFINITIONS

A. "Provide" means to furnish and install, complete and ready for operation.

1.3 REFERENCES

A. ANSI: American National Standards Institute, Inc.

B. ASHRAE: American Society of Heating, Refrigeration, and Air Conditioning Engineers.

C. ASME: American Society for Mechanical Engineers.

D. ASSE: American Society of Sanitary Engineers.

E. ASTM: American Society of Testing and Materials.

F. AWWA: American Water Works Association.

G. CISPI: Cast Iron Soil Pipe Institute.

H. FM: Factory Mutual.

I. NAIMA: North American Insulation Manufacturers Association.

J. NEMA: National Electrical Manufacturers Association.

K. NFPA: National Fire Protection Association.

L. NSF: National Sanitation Foundation.

M. MSS: Manufacturers Standardized Society of the Valve and Fittings Industry.

N. PDI: Plumbing and Drainage Institute.

O. UL: Underwriters Laboratories, Inc.

1.4 REGULATORY REQUIREMENTS

A. Comply with current edition, unless otherwise noted, of the following codes and standards:
   1. ASME B31.9 – Building Services Piping.
   2. ADA – American's with Disabilities Act.
   3. NFPA 70 – National Electrical Code.
   4. NFPA 101 – Life Safety Code.
   5. IBC – International Building Code with Fire, Mechanical, Plumbing, and Gas Codes; 2015 Edition.
   6. International Energy Conservation Code: 2015 Edition.
   7. Alabama Boiler and Pressure Vessel Code.
   8. Local Health Department.

B. Permits, Licenses, Inspections and Fees:
   1. Obtain and pay all permits, licenses, inspections and fees, and comply with all rules, laws and ordinances pertaining to the Contractor's portion of the Work.
   2. Obtain and pay for certificates of required inspections, and file certificates with Owner.

1.5 PRODUCT REQUIREMENTS

A. Provide new standard, materials throughout.

B. Multiple items of similar equipment shall be the product of the same manufacturer.

C. Substitutions:
1. Comply with the provisions of Division 01, Section "Product Requirements" and the following.
2. When several manufacturers are named in the specifications, the corresponding products and models made by the specified manufacturers will be accepted and Contractor may base his bid on any one of those products. However, if the Contractor's bid is based on products other than the scheduled or specified **basis of design**, it shall be understood that there will be no extra cost involved whatsoever, and the effect on other trades has been included in the Contractor's proposal. Coordination with other trades for substituted equipment or use of products other than the named basis of design shall be the responsibility of the Contractor furnishing the equipment.
3. The basis of design manufacturer's equipment has been used to determine space requirements. Should another approved manufacturer's equipment be used in preparing proposals, Contractor shall be responsible for determining that said equipment will fit space allocated. Submission of shop drawings or product data on such equipment shall be considered as indicating that the Contractor has reviewed the space requirements and the submitted equipment will fit the space allocated with due consideration given to access required for maintenance and code purposes.
4. The basis of design manufacturer's equipment and scheduled Plumbing equipment electrical requirements have been used to coordinate the electrical requirements of the plumbing equipment with the electrical systems serving that equipment.
    a. Contractor shall coordinate the electrical requirements of the equipment actually furnished on this project and provide the electrical systems required by that equipment at no additional cost to the Owner.
    b. Equipment of higher or lower electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at no additional cost to the Owner.
    c. Prior to approval of submittals of plumbing equipment with electrical requirements that are greater or lower than those shown on the Drawings, Contractor shall submit letter verifying that required changes to the electrical system, serving the specific piece of equipment in question, have been coordinated with the electrical contractor. Letter to be included with the associated equipment submittal, addressed to the Architect with a copy to the electrical engineer.
    d. If minimum energy ratings or efficiencies are specified, equipment shall comply with specified requirements.
5. Each Bidder may submit to the Architect a list of any substitutes which he proposes to use in lieu of the equipment or material named in the specifications with a request for the approval of proposed substitutes. To be considered, such requests must be delivered to the office of the Architect not later than 10 days prior to bid due date. The submittal shall include the following:
    a. Specific equipment or material proposed for substitution giving manufacturer, catalog and model number.
    b. All performance and dimensional data necessary for comparison of the proposed substitute with the equipment or material specified.
    c. A statement setting forth any changes in other materials, equipment or other Work that incorporation of the substitute may require.
6. The burden of proof of the merit of the proposed substitute is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution is final.

1.6 SUBMITTALS

A. Submit under provisions of Division 01, Section "Submittal Procedures" and the following.

B. Product Data: Submit to the Architect and obtain his approval of a complete list of materials and equipment which are to be provided under the 220400 Sections of Division 22.
   1. List shall be complete with manufacturer names, catalog number, dimensions, specifications, rating data and options utilized. Capacities shall be in the terms specified.
   2. Call attention to deviations from specified items as to operation and physical dimensions.
   3. Include performance curves for pumps.
   4. Final equipment orders shall not be placed until submittals have been returned marked "No Exceptions Noted" or "Make Corrections Noted."
   5. Bind all equipment submittals and provide index tab for each type of equipment. Submit all at one time. Reserve two sets for project Close-Out Documents.

C. Shop Drawings: Before starting work, submit and obtain approval from Architect of detailed drawings of the following, fully dimensional (including elevations of ductwork and piping) and drawn to 1/4" to 1'-0" scale. Submit electronic file of each drawing in PDF format. Engineer will return electronic copy of marked-up drawings. Failure to submit shop drawings will make the Contractor responsible for changes required to facilitate installation.
   1. For multi-story buildings, submit detailed floor penetration sleeve layout drawings. See Division 22, Section "Plumbing Basic Materials and Methods," Article "Informational Submittals."

1.7 QUALITY ASSURANCE

A. Installer's Qualifications: Firm experienced in installation of systems similar in size and complexity to those required for this project, plus the following:
   1. Acceptable to, or licensed by, manufacturer.
   2. Not less than 3 years experience with systems.
   3. Successfully completed no less than 5 comparable scale projects using systems similar to these for this project.
   4. Current Master Plumbing's Certificate and Master's Gas Certificate issued by the State, County, and City in which the work occurs.

1.8 SUMMARY OF WORK

A. Scope: Provide all labor, materials, equipment and services necessary for the completion of all plumbing work shown or specified, except work specified to be done or furnished by others, complete and ready for operation.

B. Equipment Furnished by Others:
   1. Connect to all equipment shown on plumbing drawings that require plumbing connections.
   2. Provide piping, shut-off valves, and unions required for a complete installation.
   3. Equipment furnished by others include:
      a. Casework.
      b. Ice machines.
      c. Coffee makers.
      d. Refrigerators

1.9 DRAWING INTERPRETATION AND COORDINATION

A. Drawings are intended to show size, capacity, approximate location, direction and general relationship of one phase to another, but not exact detail or arrangement.

B. Do not scale drawings for location of system components. Check all measurements, location of pipe, ducts, and equipment with the detail architectural, structural, and electrical drawings and conditions existing in the field and lay out work so as to fit in with ceiling grids, lighting and other parts.

C. Make minor adjustments in the field as required to provide the optimum result to facilitate ease of service, efficient operation, and best appearance.

D. Where doubt arises as to the meaning of the drawings and specifications, obtain the Architect's written decision before proceeding with parts affected; otherwise assume liability for damage to other work and for making necessary corrections to work in question.

E. Refer to Architectural Drawings for all dimensions.

1.10 PROJECT / SITE CONDITIONS

A. Visiting Site: Visit site and become familiar with location and various conditions affecting work. No additional allowance will be granted because of lack of knowledge of such conditions.

B. Determine sizes, locations, and inverts of existing and new utilities near site.

C. Cause as little interference or interruption of existing utilities and service as possible. Schedule work which will cause interference or interruption in advance with Owner, authorities having jurisdiction, and all affected trades.

1.11 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit under provisions of Division 01, Sections "Closeout Procedures" and "Project Record Documents" and the following.

B. Record Drawings:
1. Keep accurate record of corrections, variations, and deviations, including those required by change orders to the Plumbing drawings.
2. Accurately show location, size and elevation of new exterior work dimensioned from permanent structure.
3. Record changes daily on a set of prints kept at the job site.
4. Submit prints marked as noted above to Architect for review prior to request for final payment.
5. Marked prints will be returned to Contractor for use in preparing Record Drawings.

C. Prior to the issuance of a certificate for final payment, submit to Architect and obtain his approval of the following:
1. Record drawings – plumbing piping (PDF reproducibles) and electronic files in AutoCAD.
2. Equipment Submittal Data (2).
3. Equipment operating and maintenance manuals (2).
4. Equipment warranty dates and guarantees (2).
5. Pressure vessel certificates (2).
6. Certificate of Disinfection of domestic water lines.
7. List of Owner's Personnel who have received operating and maintenance instructions.
8. Submit factory start-up/field reports for:
    a. Domestic water heaters.
    b. Domestic hot water recirculating pumps

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 22 0401

SECTION 22 0403

BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Description of common piping, equipment, materials and installation for Plumbing systems.

B. This Section includes the following:
1. Piping materials and installation instructions common to most Plumbing piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Concrete.
7. Grout.
8. Escutcheons.
9. Access doors - Building.
10. Flashing
11. Workmanship.
12. Cutting and patching.
13. Excavation, trenching and backfilling.
14. Piping systems installation - Common Requirements.
15. Equipment installation - Common Requirements.
16. Painting and finishing.
17. Concrete bases.
18. Supports and anchorages.
19. Protection and cleaning of equipment and materials.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:
1. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1.3 SUBMITTALS

A. Product Data: For the following:
   1. Transition fittings.
   2. Dielectric fittings.
   3. Mechanical sleeve seals.
   4. Escutcheons.
   5. Access doors - building.

1.4 INFORMATIONAL SUBMITTALS

A. Shop Drawings: For multi-story buildings, submit detailed drawings of the floor penetration sleeve sizes and locations, including the following information:
   1. Fully dimensioned off column lines with location respective to adjacent walls shown.
   2. Sleeve size.
   3. Pipe size and insulation thickness.
   4. Pipe service.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture. If pipes do not ship with end caps, cover ends of pipe stored on site with 6 mil plastic.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for Plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves and inserts in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate installation of building access doors for Plumbing items requiring access that are concealed behind finished surfaces.

D. Electrical Characteristics for Plumbing Equipment:
   1. Coordinate electrical system installation to match requirements of equipment furnished on this project.
   2. If minimum energy ratings or efficiencies are specified, equipment shall comply with these requirements.
   3. Include a letter with the respective equipment submittal from the electrical contractor and approved by electrical design consultant, detailing changes to the electrical system required to accommodate changes in the power distribution system to accommodate Plumbing equipment that has different electrical power requirements from that equipment used as basis of design, or power provisions, as shown on the electrical drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:

2.2 PIPE, TUBE AND FITTINGS

A. Refer to individual Division 22 Plumbing Piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 Plumbing Piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

G. Press Fit: EPDM O-rings meeting performance criteria of IAPMO PS 117.

H. Composite Automatic Couplers (Transair®) ISO 4414

2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:
   1. For pipe sizes NPS 2 and smaller: PVC or CPVC, Schedule 80, one-piece fitting; one end with threaded brass insert, and one solvent-cement socket or threaded end.
   2. For pipe sizes larger than NPS 2: Flanged joints.

B. Fitting-Type Transition Couplings:
   1. Manufactured piping coupling or specified piping system fitting.

2.5 DIELECTRIC FITTINGS

A. Dielectric Nipples:
   1. Manufacturers:
      a. Perfection Corp.
      b. Precision Plumbing Products, Inc.
      c. Sioux Chief Manufacturing Co., Inc.
      d. Victaulic Co. of America; Clearflow Dielectric Waterway Style 47.

   2. Zinc electroplated steel nipple with inert and noncorrosive, thermoplastic lining; treaded ends; and 300 psig minimum working pressure at 230 deg F. Ring-groove to lock liner to steel casing and provide indentifying roll marking.

B. Dielectric Flanges:
   1. Manufacturers:
      a. Capital Manufacturing.
      b. Central Plastics.
      c. Watts.
      d. Wilkins, a Zurn Company.
   2. Standard: ASSE 1079.
   3. Factory-fabricated, bolted, companion-flange assembly.
   4. End Connections: Solder-joint or thread copper alloy and thread ferrous.
   5. Dielectric Flange Insulating Kits:
      a. Non-conducting materials for field assembly or companion flanges.
      b. Gasket: Neoprene or phenolic.
      c. Bolt Sleeves: Phenolic or polyethylene.
      d. Washers: Phenolic with steel backing washers.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
   1. Available Manufacturers:
      a. Calpico, Inc.
      b. Innerlynx, Advance Products & Systems, Inc.
      c. Link-Seal by Thunderline.
      d. Metraflex Co.
      e. Pipeline Seal and Insulator, Inc.
   2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   3. Pressure Plates: Plastic. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.
   5. Provide high temperature and U.L. fire rating at fire rated wall penetrations.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 20 gauge minimum thickness; round tube closed with longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Firestopping Sealant: See Division 07 Sections “Through-Penetration Firestop Systems” and “Fire Resistive Joint Systems” for firestopping sealant requirements.

D. Stuffing Insulation: Glass fiber type, non-combustible.

E. PVC Pipe: ASTM D2665 and ASTM D1785, Schedule 40.
   1. For PEX tubing passing through walls only.

2.8 CONCRETE

A. Nominal weight concrete (145 PCF) using Type I Portland Cement, 1-inch maximum size coarse aggregate to provide a minimum 28 day compressive strength of 3000 psi.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
   1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.10 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
1. Finish: Polished chrome-plated.

2.11 ACCESS DOORS – BUILDING

A. Manufacturers:
1. Bilco.
2. Milcor.
3. Nystrom.

B. Construction:
1. Door: 14-gauge, cold rolled steel.
2. Frame: 16-gauge, cold rolled steel of configuration to suit material application.
3. Hinge: Concealed spring hinge.
4. Latch: Screwdriver cam latch.
5. Finish: Phosphate dipped and prime coated.
6. UL labeled when in fire-rated construction with rating to match construction.
7. Stainless steel (Type 304) shall be used in ceramic tile or glazed structural tile.

C. Size: 16 inch x 16 inch minimum, as indicated on drawings, or as required to allow inspection, service, and removal of concealed items.

2.12 FLASHING

A. Flexible Flashing: 47 mil thick sheet butyl compatible with roofing.

B. Lead Flashing: Waterproofing, 5 lb/SF sheet lead.

C. Pitch Cups: 20 gauge galvanized steel, minimum 8 inches deep, bases mitered and soldered and extending at least 4 inches horizontally.

D. Shower Pans: Specified in Division 09, Section “Ceramic Tile.”

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. First class and in accordance with best practice. Work to be orderly, neat, workmanlike in appearance and performed by skilled craftsman.

B. Poor or improper workmanship shall be removed and replaced as directed by the Architect without additional cost to the Owner or design professionals.

3.2 CUTTING AND PATCHING

A. Comply with the requirements of other Divisions for the cutting and patching required to accommodate the installation of Plumbing work. Repair and finish to match surrounding.

B. Architect’s approval required before cutting any part where strength or appearance of finished work is involved.

C. Openings are to be laid out and built-in, set sleeves and inserts and furnish detailed layout drawings to other trades in advance of their work.
1. See Part 1 – 1.4 Informational Submittals above.

D. Core drill or saw cut openings in existing masonry construction.

3.3 EXCAVATION, TRENCHING AND BACKFILLING

A. Provide trenching, excavation, backfilling necessary for performance of work, including excavation of rock and all other materials which may be encountered.

B. Grade bottom of trenches evenly and excavate bell holes to insure uniform bearing for the full pipe length. Excavate minimum 6 inches below pipe. Refill cuts below grade with sand.

C. Backfill after inspection by Architect and authorities having jurisdiction. Backfill compacted areas (engineered fill) with sand or fine gravel in accordance with requirements in Division 31. Section “Earthwork” no less than 95% compactancy. Backfill paved areas with sand or fine gravel compacted to meet requirements of Paving Section. Backfill shall be free of rock, wood, steel, brick, etc. Do not disturb pipe.

D. Refer to Division 22, Plumbing Piping Sections for specific bedding and backfill requirements.
   1. For factory or field insulation or coated piping, the bedding shall be a minimum of 6 inches of sand. The first 12 inches of backfill above the pipe shall be sand.

E. Restore existing pavement, curbs, sidewalks, sodding, bushes, etc., matching surroundings.

F. Restore all pavement cuts to meet the requirements of the cuts of the local authority.

3.4 PIPING SYSTEMS INSTALLATION - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Plumbing Sections specifying piping systems.

B. Drawings, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and in service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections. No mitering or notching for fittings permitted.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons where exposed, non-insulated piping penetrates walls, ceilings, and floors in finished spaces.

M. Connections to compressed air mains shall be made to the top of the main.

3.5 SLEEVES

A. Sleeves are not required for core-drilled holes, or wall hydrants.

1. In mechanical room floors and other potentially wet areas, provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
   1. Cut sleeves to length so that sleeve extends out ½ inch from both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas, or other potentially wet areas, 1-1/2 inches above finished floor level. Caulk space outside of sleeves water tight.
   2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
   3. Use the following sleeve materials:
      a. Sleeves for Piping Through Concrete Beams, Concrete Walls, Footings, and Potentially Wet Floors: Steel pipe.
      b. Sleeves for Piping Through Masonry Walls and Gypsum Board Partitions: Steel sheet sleeves 1/2 inch larger than pipe or pipe covering.
   4. Where piping penetrates non-rated equipment room wall, floors or roofs outside of a shaft, close off space between pipe or duct and adjacent work with stuffing insulation and caulk air tight.
   5. Above ground, non-rated, exterior wall penetrations: Seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
   6. Provide for continuous insulation wrapping thru sleeve.
   7. Seal space around the outside of sleeves with grout at masonry walls and floors and dry wall mud at gypsum board partitions.

C. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

D. Fire-Rated Penetrations: Where pipes pass through fire-rated and fire-resistive floors, walls, and partitions, install appropriately rated sleeves and firestopping sealant. Firestopping materials and installation methods are specified in Division 07 Sections “Through Penetration Firestop Systems” and “Fire Resistive Joint Systems”.

E. Cast in Place Sleeving System Installation:
   1. General: Install penetration firestopping to comply with manufacturer’s published installation instructions and drawings for products and applications indicated.
   2. Install forming materials and other accessories of types required to support fill materials during application in the position needed to produce cross-sectional shapes and depths required for the fire ratings required:
      a. After installing fill materials and allowing them to fully cure, remove combustible forming materials and accessories not indicated as permanent components of firestopping.

3.6 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Plumbing Piping Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

G. Flanged Joints:
1. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.
2. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.

I. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

J. Composite automatic couplers:
1. Composite automatic couplers shall be installed in accordance with manufacturers installation instructions.

K. Press Fit:
1. Copper press connections shall be made in accordance with manufacturers installation instructions.
2. Copper tubing shall be fully inserted into the fitting and checked.
3. The joints shall be pressed using tools approved by the manufacturer.
4. Joints shall meet performance criteria of IAPMO PS 117. Fittings shall conform to ASME 16.22.

3.7 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Wet Piping Systems: Install dielectric fittings to connect piping materials of dissimilar metals.

3.8 PIPE CLEANING

A. Keep pipe clean and free of dirt. Keep caps on ends of pipe when it is stored on site and reinstall caps on ends of installed piping at the end of each day.

3.9 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

D. Install equipment in accordance with manufacturer's instructions. If manufacturer's instructions conflict with Contract Documents, obtain Architect's decision before proceeding.

E. Install equipment to allow right of way for piping installed at a required slope.

F. All equipment shall be firmly fastened in place:
   1. Pad mounted equipment shall be secured to pads using poured in place anchor bolts or cinch anchors.
   2. Vibration isolators shall be secured to floors or pads and equipment shall be bolted to the isolators.

G. All back-to-back floor mounted water closets shall be connected via a double combination wye and 1/8 bend. Sanitary crosses are **NOT** acceptable.

3.10 PAINTING AND FINISHING

A. Except as specified below or noted on the Drawing, requirements for painting of Plumbing systems, equipment, and components are specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Paint water pipe and insulation downstream of backflow preventor (non-potable water) to termination point, or to connection with mechanical system piping, purple.

3.11 CONCRETE BASES

A. Provide concrete foundations with nominal dimensions conforming to the following schedule for floor-mounted equipment:

Equipment	Foundation
Domestic water heaters	4" high pad
Equipment and piping stands and supports	4" high pad

B. Concrete bases shall be continuous and shall have beveled edges and smooth float finish. Concrete bases shall be reinforced with No. 3 bars a maximum of 12" on center each way, and held in place with dowel rods at each corner anchored in the slab. Dowel rods shall not penetrate through the slab.

C. Roughen and clean exposed slabs before pouring foundations. Apply bonding agent to surfaces in contact.

D. Concrete pads shall extend a minimum of 4" beyond the equipment footprint in all directions, including appurtenances, vibration isolators, base elbow supports, and motors.

E. Equipment attached directly to foundations or inertia bases; bases provided with grout holes; and bases consisting of a structural frame shall have voids filled with grout after attachment to foundation.

F. Fill voids between baseplates and foundations, and level equipment, with grout.

3.12 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" requirements.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.13 GROUTING

A. Mix and install grout for Plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.14 ACCESS DOORS – BUILDING

A. Provide access doors in wall and inaccessible ceilings to allow access to service and maintain concealed Plumbing equipment, valves, etc.

B. Coordinate installation of access doors with Divisions responsible for Building System in which panels are being installed.

3.15 FLASHING

A. Provide flexible flashing and metal counterflashing where pitch cups and piping penetrate weather or waterproofed walls, floors and roofs.

3.16 PROTECTION AND CLEANING OF EQUIPMENT, FIXTURES, AND MATERIALS

A. Equipment, fixtures, and materials shall be carefully handled, properly stored, and protected from weather, dust-producing procedures, or damage during construction.

B. At completion of all work, thoroughly clean, exposed materials (pipe, etc.), equipment, and fixtures and make ready for painting.

END SECTION 22 0403

SECTION 22 0405

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, including color and letter style.

1.3 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, “Scheme for the Identification of Piping Systems,” for letter size, length of color field, colors, and viewing angles of identification devices for piping, unless otherwise noted herein.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16-inch thick, and having predrilled holes for attachment hardware.
2. Color Coding:

System	Background Color	Letters
Equipment served by emergency power	Red	White
Other equipment	Black	White

3. Temperatures up to 160 deg F.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4-inch.
5. Minimum Letter Size: Minimum ½-inch high. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless-steel self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16-inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4-inch.

F. Minimum Letter Size: Minimum 1/2-inch high for viewing distances up to 72-inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information as indicated elsewhere in the Specifications and on the Drawings.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
   1. Colors: Comply with ASME A13.1, unless otherwise indicated.
   2. Lettering: Use piping system terms indicated on the Drawings. Abbreviate only as necessary for each application length.

B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to partially cover circumference of pipe on lines 6-inches outside diameter, including insulation, and smaller; Snap on, on lines over 6-inches outside diameter, including insulation, and secure with nylon straps.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on the Drawings and an arrow(s) indicating flow direction.
   1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions; or as a separate unit on each pipe label to indicate flow direction.
   2. Lettering Size: At least 1-1/4-inches high for 2-1/2-inch and larger pipe outside diameter, including insulation.

D. Following existing labeling color and format in existing buildings, unless otherwise directed by the Architect.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of Plumbing equipment.

B. Install or permanently fasten labels on starters furnished under this Division.

C. Locate equipment labels where accessible and visible.

3.3 WARNING-SIGNS AND LABELS INSTALLATION

A. Write required message on, and attach warning tags to equipment and other items where required in the specifications or shown on the Drawings.

3.4 PIPE LABEL INSTALLATION

A. Identify piping specified under this Division in accordance with ANSI/ASME A13.1.

B. Locate pipe labels where piping is exposed, or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows: **(Note: In finished spaces, obtain direction from Architect prior to installing pipe labels.)**
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
   4. Near each change in direction.
   5. At access doors, manholes, and similar access points that permit view of concealed piping.
   6. Near major equipment items and other points of origination and termination.
   7. Spaced at maximum intervals of 20 feet along each run.

C. Pipe Label Color Schedule:

Piping System	Background Color	Letter Color
Domestic Cold-Water	Green	White
Domestic Hot-Water Piping	Green	White
Domestic Hot-Water Return Piping	Green	White
Non-Potable Water	Purple	White
Soil	Green	White
Waste	Green	White
Vent	Green	White

END OF SECTION 22 0405

SECTION 22 0407

PLUMBING SYSTEMS INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

1.2 RELATED SECTIONS

A. Division 07 – Firestopping.

B. Division 22 – Section 220405 “Identification for Plumbing Piping and Equipment.”

C. Division 22 – Section 220410 “Plumbing Piping”: Placement of hangers and hanger inserts.

1.3 SUBMITTALS FOR REVIEW

A. Section 220401: Procedures for submittals.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing insulation work with minimum 3 years’ experience.

1.5 REGULATORY REQUIREMENTS

A. Conform to maximum flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255 or UL 723.

B. All insulation materials, adhesives, mastic and coating shall be asbestos free.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufactures for Fiberglass Insulation Materials:
1. Owens-Corning.
2. Certainteed.
3. Knauf.
4. Johns Manville Corporation

B. Acceptable Manufacturers for Adhesives, Mastics and Coatings:
1. Armstrong.
2. Benjamin Foster.
3. Childers.
4. Marathon.

2.2 GLASS FIBER PIPE INSULATION

A. Manufacturer: Owens-Corning Model SSL-11.

B. Insulation: ASTM C547; rigid molded, noncombustible.
1. ‘K’ value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum service temperature: 850 degrees F.
3. Maximum moisture absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket:

1. White kraft paper with glass fiber yarn, bonded to aluminized film.
2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.

D. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive:
1. Compatible with insulation.

F. Insulating Cement/Mastic:
1. ASTM C195; hydraulic setting on mineral wool.

2.3 JACKETS – PIPING AND EQUIPMENT

A. Canvas Jacket: UL Listed.
1. Fabric: ASTM C921, 6 oz/sq yd plain weave cotton treated with dilute fire retardant lagging adhesive.
2. Lagging Adhesive: Compatible with insulation.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and jacketed outdoor use on below ambient services.
1. Products:
   a. Childers Products, Division of ITW; CP-35.
   b. Foster Products Corporation, H.B. Fuller Company; 30-90.
   c. ITW TACC, Division of Illinois Tool Works; CB-50.
   d. Marathon Industries, Inc.; 590.
   e. Mon-Eco Industries, Inc.; 55-40.
   f. Vimasco Corporation; 749.
2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping and equipment have been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with NAIMA National Insulation Standards.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

D. Fit pipe hangers over insulation.

E. Inserts and Shields:
1. Application: Protect insulated piping at hangers and supports with insulation shield. On pipe sizes over 2 inches, provide insert.

2. Insulation Protection Shield: Galvanized steel formed in half circle to fit insulation. Length and gauge as follows:
   a. Up to NPS 4: 12 inches long and 22 gauge.
   b. NPS 6: 18 inches long and 22 gauge.
   c. NPS 8 through 12: 24 inches long and 18 gauge.
   d. NPS 14 and Large: 24 inches long and 16 gauge.
3. Insulation-Insert Material: Water repellent treated, ASTM C533, Type I calcium silicate; or ASTM C552, Type II cellular glass of same thickness and vapor barrier jacket specified for surrounding insulation. Insert shall be a minimum of 2 inches longer than the shield.
4. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
5. For Clevis Hangers: Insert shall cover lower 180 degrees of pipe.
6. Option: At Contractor's option, insert may be factory fabricated Thermal Hanger Shield (insulation insert encased in sheet metal shield) equal to Pipe Shield, Inc. "Insulated Pipe Supports."
7. Option: At Contractor's option, steel pipe saddles may be used on hot water pipe in lieu of insert and shield. Fill interior void of saddle with insulation that matches adjoining insulation.

F. Continue insulation through metal studs, walls, sleeves, pipe hangers, and other pipe penetrations. Finish firestopping at supports, protrusions, and interruptions. At fire separations, refer to Division 07 and Section 220410: Sleeves.

G. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.3 GLASS FIBER PIPE INSULATION APPLICATION

A. Provide vapor barrier jackets, factory or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding stapes 4 inch on center and vapor barrier mastic.

B. Insulate fittings, joints and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

C. **Finish fittings exposed in equipment rooms, boiler rooms and in finished spaces with vinyl acrylic mastic over glass fab**.

D. For hot piping do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

3.4 SCHEDULES - PIPING

A. Plumbing Piping:
1. Domestic Cold Water Interior, Above Grade:
   a. Glass Fiber Pipe Insulation
      1) All pipe sizes: 1 inch thick.
      2) Pipes located in walls: ½ inch thick.
2. Domestic Hot and Recirculating Water Interior, Above Grade:
   a. Glass Fiber Pipe Insulation
      1) All pipe sizes: 1 inch thick.
      2) Pipe located in walls: ½ inch thick.

3.5 INSTALLATION – EQUIPMENT INSULATION GENERAL

A. Install in accordance with NAIMA Insulation Standards.

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires or bands.

E. Fill joints, cracks, seams and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

F. Insulated equipment containing fluids below ambient temperature: Insulate entire system.

G. Finish insulation at supports, protrusions, and interruptions.

H. Equipment in Mechanical Rooms or Finished Spaces: Finish with canvas jacket or as scheduled.

I. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

J. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

END OF SECTION 22 0407

SECTION 22 0410

PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, valves for the following piping systems:
   1. Sanitary, waste and vent piping.
   2. Domestic, hot and cold water piping.

1.2 RELATED SECTIONS

A. Section 220401 – General Plumbing Requirements.

B. Section 220403 – Basic Plumbing Materials and Methods.

C. Section 220405 – Identification for Plumbing Piping and Equipment.

D. Section 220407 – Plumbing Systems Insulation.

1.3 SUBMITTALS FOR REVIEW

A. Division 01 – Submittals and Section 220401: Procedures for submittals.

B. Provide product data on the following:
   1. Pipe materials, pipe fittings and accessories.
   2. Manufacturers catalogue data and cut sheets on all fixtures and equipment.
   3. Valve data and ratings.

C. Manufacturer's drawings of listed closing methods to be used to close penetrations through rated assemblies.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with the City of Tuscaloosa, Alabama, codes and standards.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

PART 2 - PRODUCTS

2.1 SANITARY WASTE PIPING, BELOW GRADE OR BELOW SLAB ON GRADE

A. PVC Pipe:
   1. Pipe: Schedule 40, ASTM D2665 and ASTM D1785.
   2. Fittings: PVC with DWV pattern, ASTM D2665.
   3. Joints: ASTM D2855, solvent weld with ASTM F-656 purple primer and ASTM D2564 solvent cement.

2.2 SANITARY WASTE AND VENT PIPING, ABOVE SLAB ON GRADE

A. Cast Iron Pipe:
   1. Pipe: CISPI 301, hubless, service weight, bituminous coating.
   2. Fittings: Cast iron, bituminous coated.
   3. Joints: CISPI 310, neoprene gaskets and stainless steel clamp and shield assemblies. All standard duty hubless couplings shall meet CISPI 310 and be listed by NSF International.
      a. Approved manufacturers: Husky HD 2000, Mission Heavyweight or Clamp All-80.
      b. Approved manufacturers: Anaco Husky HD 4000, Ideal-Tridon Super Heavy Duty "HD" no-hub couplings, fernco HD Heavy Duty no-hub couplings.

2.3 WATER PIPING, BELOW SLAB ON GRADE OR BELOW GRADE

A. Copper Tubing:
   1. Pipe: ASTM B88, Type K soft copper.
   2. Fittings: ASME B16.22 wrought copper and bronze.
   3. Joints: "Sil-Fos".
   4. Piping to be installed to minimize the number of joints below grade of or below slab on grade.
   5. Encase all below ground copper piping in plastic sleeve or 1/2" unsplit foam insulation.

2.4 WATER PIPING, ABOVE GRADE

A. Copper Tubing:
   1. Pipe: ASTM B88, Type L, hard drawn.
   2. Fittings: ASME B16.22, wrought copper and bronze.
   3. Joints: ASTM B32, 95-5 solder, Grade 95TA, lead free with lead free flux.

B. Insulation:
   1. Insulate all water piping (cold, hot and hot return) above slab on grade with 1" fiberglass insulation. Insulation thickness may be reduced to 1/2 inch walls. Foam type insulation may be used in concrete block walls.
   2. Insulation shall be installed continuous through walls.
   3. See Section 220407 of the specifications for insulation description.

C. Identification:
   1. Identify all piping in accordance with Section 220405 of the specification.

2.5 FLEXIBLE PIPE CONNECTIONS

A. Stainless steel corrugated tubing with stainless steel wire braid.

B. Working pressure 200 psi minimum.

C. End connections 2” and smaller-male pipe threads, larger than 2” flanged.

D. Manufacturers: Minnesota Flexible Corporation, Metaflex, Flexicraft and Hyspan.

2.6 FLANGES, UNIONS, AND COUPLINGS

A. Pipe Size 2 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Pipe Size Over 2 Inches:
   1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Dielectric Connections: Dielectric waterway; zinc electroplated steel nipple with thermoplastic liner and threaded ends.

2.7 PIPE HANGERS AND SUPPORTS

A. Hangers:
   1. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Carbon steel, adjustable swivel, split ring.
   2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods or Unistrut multiuse channel.
   4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

5. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
6. Vertical Support: Steel riser clamp.
7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
8. Copper Pipe Support when applied directly to the copper piping: Copper steel ring, adjustable.
9. Install hanger over insulation on insulated pipe with sheet metal saddle rolled on the ends centered in hanger. See Section 220407.

B. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

C. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

D. Roof Supports:
1. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Erico PP50H6.
2. Hangers for Pipe Sizes 2 Inches and Over: Erico PP50H6.
3. Vertical Support: Steel riser clamp.

E. For fasteners in existing concrete structures, use drilled in expansion anchors with load rating 150% greater than the pipe hanger rating. Note: Powder drive anchors are not acceptable.

F. Beam Clamps: Grinnell Figure #229.

2.8 BALL VALVES (LEAD FREE)

A. Up to and including 4 inches:
1. Manufacturers:
a. Jomar JF-100SG / JF-100TG full port.
b. Nibco, Apollo, Milwaukee, Kitz 868M/869M (3/8”-2”).
2. MSS-SP-110 Class 125, lead free bronze body, 316 stainless steel full port ball and stem, PTFE seats and seals, blow-out proof stem and threaded ends.

2.9 BUTTERFLY VALVES (LEAD FREE)

A. For pipe sizes 4 inches and larger
1. Manufacturers
a. Kitz 6133EL
b. Nibco, Jomar, Watts, Apollo, Milwaukee
2. Ductile iron body, lug style, stainless steel disc and stem, 10 position handle, EPDM o-rings
3. 250 PSI
4. Conforms to NSF 61, MSS-SP-67

2.10 BALANCING VALVES (CIRCUIT SETTER)

A. Manufacturer:
1. Caleffi 142251A Series, 3/4-inch variable orifice balancing valve.

B. Install on hot water return line at point of connection to hot water return riser on main and where indicated on drawings. Provide ball valve on leaving side of flow indicator.

2.11 SWING CHECK VALVES (LEAD FREE)

A. Up to and Including 3 Inches:
1. Manufactures:
a. Nibco Model S-413-Y-LF or T-413-B-LF.
b. Crane, Stockham, Milwaukee, Kitz.

2. MSS SP-80 and MSS SP-139, Class 125, bronze body and cap, bronze trim and seat, threaded ends.

2.12 WATER PRESSURE REDUCING VALVES

A. Provide water pressure reducing valve at the service entry on all buildings where main pressure is in excess of 80 psi. Set out pressure at 70 psi.

B. Up to and Including 2 Inches:
   1. Manufactures:
      a. Watts Model U5B.
      b. Wilkins, Cash, Acme.
   2. MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, internal by-pass, inlet strainer, threaded ends with single union and ball valve upstream of strainer.

C. Over 2 Inches:
   1. Manufactures:
      a. Watts ACV 115.
      b. Williams, Cash, Acme.
   2. MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

D. Provide pressure gage (0-150 PSI) with needle valve stop on leaving side of pressure reducing valve

2.13 THERMOMETERS

A. Lights actuated digital thermometer reading in degrees Fahrenheit. Provide with well for minimum 1" insulation.

B. Weiss Vari-angle Digital Thermometer.

2.14 PRESSURE GAUGE (DOMESTIC WATER)

A. Manufacturers:
   1. Trerice.
   2. Weiss.
   3. Weksler.
   4. Winters.

B. 4-1/2-inch diameter, minimum dial face, stamped stainless steel, replaceable glass lens, with snap-on rings. Phosphor bronze tube, bronze brushed rotary movement, silver brazed or soldered to brass socket and brass tip, 1/4-inch bottom connection. Accuracy, on (1.0) percent of included scale range. White dial face with black numerals, graduated in pounds; equipped with bronze pulsation dampener or snubber and needle valve.

2.15 SLEEVES

A. Refer to Division 22, Section "Basic Plumbing Materials and Methods" for requirements.

2.16 FIRE STOP SYSTEM

A. All wall and floor penetrations are to be closed. Refer to the Arch. Life Safety Plans and close all openings with a U.L. Listed assembly compatible with the rating of the wall or floor being penetrated.

B. Non-rated walls:
   1. Sheet rock joint compound may be used to seal opening. Insulation to be continuous through wall.

C. For piping passing through sheet rock walls or partitions:

1. Insulated pipe passing through 2 walls or partitions – Hilti FS605 with sleeve U.L. Listing #WL1056.
2. Insulated pipe passing through 2 hour walls or partitions – Hilti FS611A with no sleeve, U.L. Listing #WL5029. Insulation to be continuous through sleeve.

D. For piping passing through concrete floors, concrete walls or concrete block walls:
1. Uninsulated Schedule 40 steel on copper pipe: Hilti #F5605 with sleeve, U.L. #CAT155.
2. Insulated Schedule 40 steel on insulated copper pipe: Hilti #FS6114A, U.L. #CAT5045.

E. For non-metallic piping passing through concrete floors, walls or concrete block.
1. 2” and smaller piping: Hilti #FS611A, U.L. #CAT2062 or U.L. #CAT2065.
2. Larger than 2”: Hilti #FS611A with collar, U.L. #CAT095.

2.17 FLASHING

A. Refer to Division 22, Section “Basic Plumbing Materials and Methods” for requirements.

2.18 WATER HAMMER ARRESTERS

A. Install water piping to ASME B31.9. Closed copper tube chamber with permanently sealed 410 kPa (60 psig) air charge above a Double O-ring piston. Two high heat Buna-N O-rings pressure packed and lubricated with FDA approved silicone compound. All units shall be designed in accordance with ASSE 1010 for sealed wall installations without an access panel. Size and install in accordance with Manufacturers requirements. Unit shall be as manufactured by Precision Plumbing Products, Inc., Watts, or Sioux Chief. Provide water hammer arrestors at:
1. All solenoid valves.
2. All groups of two or more flush valves.
3. All quick opening or closing valves.
4. All washing equipment.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cut pipe square and ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Provide quarter turn, full port ball valve between all pressure gauges and piping system.

3.2 PIPING INSTALLATION GENERAL

A. Install in accordance with manufacturer’s instructions.

B. Provide dielectric fittings wherever jointing dissimilar metals.

C. Make piping connections to equipment with flanges or unions.

D. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

E. Run piping concealed, except where specifically shown to be exposed.

F. Install piping to maintain headroom, conserve space, and not interfere with use of space.

G. Group piping whenever practical at common elevations.

H. Install piping to allow for expansion and contraction without stressing pipe, joints or connected equipment.

I. Provide clearance in hanger and from structure and other equipment for installation of insulation and access to valves and fittings.

J. Provide access where valve is not accessible. Provide minimum 18”x18” access doors at valves in hard ceiling.

K. Establish elevations of buried pressure piping outside the building to ensure not less than 18 inches of cover.

L. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 099100.

N. Install chrome plated floor, wall and ceiling plates on all exposed piping passing through finished surfaces in finished spaces.

O. Install bell and spigot pipe with bell end upstream.

P. Install valves with stems upright or horizontal, not inverted.

Q. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, or in existing concrete structures use drilled in expansion anchors with load rating at least 150% of pipe hanger rating (powder driven anchors not acceptable).

R. Pipe Hangers and Supports:
1. Support horizontal piping as scheduled.
2. Install hangers to provide minimum ½-inch space between finished covering and adjacent work.
3. Place hangers within 12 inches of each horizontal elbow.
4. Use hangers with 1-1/2-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
6. Where several pipes can be installed in parallel and at same elevation, trapeze hangers may be used.
7. Provide copper hangers and supports when applied directly to copper piping.
8. Prime coat exposed steel hangers and supports located outdoors, in crawl spaces, pipe shafts. Above suspended ceiling spaces is not considered exposed.
9. Provide hangers adjacent to motor driven equipment.
10. Support cast iron drainage and vent piping at every joint and minimum 5'-0" on center.
11. Support of all pipe, tubing and fixtures and equipment shall be accomplished by means of engineered products specified to each application. Makeshift, field devised methods of plumbing pipe supports, such as scrap wood, wire or duct tape are not allowed. These shall be HoldRite, B-Line, Sioux Chief or approved equal.

S. Provide pipe line markers and valve tags in accordance with other sections of the specifications.

T. Sleeves:
1. Refer to Division 22, Section “Basic Plumbing Materials and Methods” for requirements.

U. Flashing:
1. Refer to Division 22, Section “Basic Plumbing Materials and Methods” for requirements.

3.3 EXCAVATION AND BACKFILLING

A. Refer to Division 22, Section “Basic Plumbing Materials and Methods” for requirements.

3.4 APPLICATION

A. Install unions at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system.

C. Install valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Provide check valves on discharge of water pumps.

E. Provide flow indicators in water recirculating systems where indicated.

3.5 ERECTION TOLERANCES

A. Slope all sanitary waste piping and storm piping at a minimum 1/8" per foot. Slope all sanitary sewer piping 2" and smaller below slab on grade at a minimum 1/4" per foot.

B. Arrange all water piping to drain to low points and provide ball valve with plug at low point.

3.6 SANITARY, WASTE AND VENT SYSTEM

A. Install vent stacks through roof. Terminate 12 inches above finish roof and minimum 10'-0" from HVAC roof top unit outside air intakes. Flashings for penetrations are under another section.

B. Connect to site sanitary sewer approximately 5'-0" from building. Verify exact size, location and invert with Civil Drawings prior to beginning work.

3.7 WATER PIPING SYSTEM

A. Connect to site water service approximately 5’-0" from building installed under another section. Verify with Civil drawings exact size and location of site water service.

3.8 FIELD QUALITY CONTROL

A. Perform all tests as required by local codes. Contractor shall furnish testing equipment and keep a record of all testing listing tests made, results and those witnessing test. Include testing record in close out documents.

B. If local codes are more stringent than the following, local codes shall govern.

C. Sanitary, Waste, Vent and Rain Water Systems:
   1. Test piping by stopping lower outlets and filling to 10 feet hydrostatic head for a minimum period of 15 minutes with all joints exposed throughout test. Stop all leaks and retest system until tight.
   2. Test all piping by stopping all outlets and applying 5 pounds per square inch of air pressure to the system for a period of 15 minutes. Stop all leaks and retest system until tight.
   3. Provide ball test on all piping 3" and larger.

D. Domestic Water Piping:
   1. Hydrostatic test at 150 psig without pressure drop for 4 hours. Stop all leaks and retest system until free from leaks.
   2. Leave City pressure on system for duration of project.

3.9 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify hot and cold water systems are complete, flushed and clean.

B. Ensure PH of water to be treated is between 7.4 and 7.6.

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 ppm residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 ppm, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water.

H. Submit sample of water from all new or modified systems to local Health Department and receive certification that water is acceptable for human consumption. Include certification of water in close out documents.

3.10 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe size: 1/2 to 1-1/4 inches:
         1) Maximum hanger spacing: 6.5 ft.
         2) Hanger rod diameter: 3/8 inch.
      b. Pipe size: 1-1/2 to 2 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 3/8 inch.
      c. Pipe size: 2-1/2 to 3 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 1/2 inch.
      d. Pipe size: 4 to 6 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 5/8 inch.
      e. Pipe size: 8 to 12 inches:
         1) Maximum hanger spacing: 14 ft.
         2) Hanger rod diameter: 7/8 inch.
      f. Pipe size: 14 inches and over:
         1) Maximum hanger spacing: 20 ft.
         2) Hanger rod diameter: 1 inch.
   2. Plastic Non-Metallic Piping:
      a. All Sizes:
         1) Maximum hanger spacing: 4 ft.
         2) Hanger rod diameter: 3/8 inch.

END OF SECTION 22 0410

SECTION 22 0440

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Plumbing fixtures.

B. Plumbing miscellaneous equipment.

1.2 RELATED SECTIONS

A. Section 220401 – Basic Plumbing Requirements.

B. Section 220403 – Basic Plumbing Materials and Methods.

C. Section 220405 – Identification for Plumbing Piping and Equipment.

D. Section 220407 – Plumbing Systems Insulation.

E. Section 220410 – Plumbing Piping.

1.3 SUBMITTALS FOR REVIEW

A. See Section 220401, Submittal for Review.

B. Plumbing Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, trim and finishes.

1.4 SUBMITTALS AT PROJECT CLOSEOUT

A. Refer to Division 01 and Section 220401 – Submittals for Project Closeout.

B. Maintenance Data: Provide 3 sets of manufacturer's maintenance and parts listing including the manufacturers nearest sales and service representative. Include the sales representative's address and telephone number. Provide with the listing, a suggested maintenance schedule for all equipment along with warranty dates. Items are to be provided in three ring binders with tabs identifying different equipment types.

C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years' experience.

1.6 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE AND PROTECTION

A. Accept fixtures on site in factory packaging, inspect for damage and store.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.8 WARRANTY

A. See other sections of the specification for additional warranty information.

B. The Contractor shall warrant all materials, workmanship and equipment for a period of one year from the date of substantial completion. Any defect in equipment or workmanship shall be made known to the Contractor within 1 year. Such deficiencies shall be corrected by the Contractor at no cost to the Owner.

1.9 EXTRA MATERIALS

A. See other sections of the specification for additional extra material requirements.

B. Provide two sets of cartridges or washers for all faucet types, two flush valve repair kits for all flush valve type and one loose key for each hose bibb or wall hydrant.

PART 2 - PRODUCTS

2.1 DRAINS

A. Mechanical Room Floor Drains (MFD): Mifab #1340-5 with sediment bucket. Provide deep seal trap, trap guard and coordinate exact location with HVAC equipment. Insulate suspended drain body and all horizontal piping serving mechanical floor drain until piping turns vertical.

B. Floor Drain (FD) and Shower Drain (SD): Mifab 1100-C-1 with 6" nickel bronze reinforced grate. Provide trap guard on floor drains and deep seal trap.

C. Hub Drain (HD): Open pipe with Jay R. Smith 3951 or 3955 fixed air gap fitting.

D. Trap Guard (TG): J.R. Smith #2692 quad close “stink stopper” trap seal device.

2.2 WALL HYDRANT

A. J.R. Smith #5519 ASSE 1052 listed wall hydrant, with integral backflow preventer, latching cover, freeze-proof and all bronze box. Provide casing of sufficient length in order that valve seat be on building side of exterior wall insulation. Install with center line 24" above finish grade and provide Owner with one (1) loose key for each wall hydrant.

2.3 HOSE BIBB

A. HB-1 Finished areas (in wall): J.R. Smith #5618 narrow wall hydrant, all bronze with integral vacuum breaker, and loose key.

B. HB-2 Un-Finished areas: Chicago Faucet #998 rough chrome plated brass with, drain plug, tee handle and vacuum breaker. Install with center line 24” above finished floor.

2.4 CLEANOUTS

A. Furnish and install cleanouts where indicated on drawings and at all 90-degree bends, angle, upper terminals and not over 75 feet apart on straight runs. All cleanouts on cast iron piping to have bronze countersunk tapered slotted plugs, except PVC piping cleanouts, which shall be standard of piping system used. Flush-with-floor cleanout access covers shall have non-skid covers. All wall cleanout access covers shall have polished satin finish. All cleanouts shall be full size of pipe, piping larger than 6" shall have minimum 6" cleanout covers.

B. Exposed Cleanouts: Cast brass plug type, J.R. Smith #4470.

C. Wall type cleanout plug and access covers, J.R. Smith #4472. Cleanout plug must be within 1" of finish wall and must be tapped for access cover. On PVC plastic waste pipe in wall; cleanout access cover J.R. Smith 4710.

D. Install wall cleanouts on stacks at flush valve fixtures 12" above top of flush value, 12” above top of flush tanks, 12" above finish floor on sinks, lavatories and water coolers and 12" above grab bars at fixtures with grab bars. Locate cleanouts to clear baseboard at floor.

E. Floor type cleanout access covers: J.R. Smith #4248-NB. Plug must be within 3" of finished floor. Provide J.R. Smith #4188 where installed in terrazzo floors and J.R. Smith #4168 where located in floor with asphalt or vinyl tile covering. Grout cleanout below access cover to seal watertight. Provide option "Y" cleanout carpet markers where installed in carpeted floors.

F. Outside Cleanouts: J.R. Smith #4258 cleanout access encased in a 18" X 18" X 6" deep concrete pad. See Detail on Drawings.

2.5 PLUMBING FIXTURES AND EQUIPMENT

A. Unless otherwise specified, all fixtures complete as catalogued, commercial grade, white color, exposed metal trim chromium plated.

B. Fixtures and brass shall be securely anchored. Carriers shall be securely anchored to floor with lug bolts in all holes as recommended by the manufacturer.

C. Flush valve "YJ" supports shall be installed 1 inch below vacuum breaker on all water closet flush valves and around vacuum breaker on urinal flush valves. Handles on A.D.A. water closets to be installed on wide side of room or stall.

D. Seal wall hung fixtures at wall with white silicone sealant. Seal countertop fixtures with clear silicone sealant.

E. Seal floor mounted water closets to floor with white silicone sealant.

F. Mount all fixtures at standard mounting height unless otherwise noted.

G. All faucets to be furnished with ceramic discs.

H. Furnish sinks and lavatories with correct number of drillings required for the faucet and accessories. Hole covers are not acceptable.

I. All similar products shall be by the same manufacturer.

J. All fixtures noted to be A.D.A. approved must be set with great care to assure proper mounting height and proper distance from wall.

K. All items complete as catalogued as follows:

WC-1 Water Closet:	Floor Mounted – Kohler K-96057 complete, Sloan G2 111-1.6GPF hardwire flush valve with YJ bracket and Church “Dura-Guard” model #2155SSCT seat.
WC-2 Water Closet: (ADA)	Floor Mounted – Kohler K-96057 complete, Sloan G2 111-1.6GPF hardwire flush valve with YJ bracket and Church “Dura-Guard” model #2155SSCT seat. Must meet ADA.
UR-1 Urinal:	Wall Hung – Kohler K-5016-ET complete, Sloan ECOS 186-0.5GPF hardwire flush valve with YJ Bracket, JR Smith #637 fixture support.
LAV-1 Lavatory:	Undermount bowl is integral to casework – T&S Brass 2867-04-LAM faucet, McGuire 155A outlet with tailpiece, McGuire 165 stops with supplies and McGuire 8872C P-Trap. Insulate P-trap, stops and supplies with

	McGuire ProWrap insulator kit. Provide TMV-1 with wall bracket installed below bowl. Must meet A.D.A.
EWC-1 Electric Water Cooler: (Bi-Level, ADA with Bottle Filling)	Elkay #EZSTL8WSLK bi-level water cooler with sensor activated bottle filling station with all stainless steel cabinet and waterways that are manufactured of 100% lead free material, J.R. Smith #834 fixture support, McGuire 8912C P-Trap and McGuire 165 stop with supply. Fully insulate P-Trap with McGuire ProWrap insulator. Install with lower spout outlet maximum 36" AFF. Must meet A.D.A.
JC-1 Janitors Receptor:	Stern Williams #HL-1800 (24" X 24") complete, T-35 hose with wall hook, stainless steel backsplash and T&S Brass B-0665-BSTR faucet with integral stops and spring checks.
SK-1 Sink:	Elkay LR2219, LK-35 strainer, Symmons S-6710-PD-1.5 faucet, McGuire 8912C P-Trap and McGuire 165 stops with supplies.
SK-2 Sink:	Elkay LRAD221955, LK-35 Strainer, T&S Brass B-2865 faucet, McGuire 8912C P-trap and McGuire 165 stops with supplies.
TMV-1 Thermostatic Mixing Valve:	Leonard Model 170D-LF Thermostatic mixing valve, installed in the “H” position with bracket secured to wall under all public and ADA lavatories. Valve must meet the minimum flow rate of .25 gpm. Set hot water temperature at 109 deg F and pipe as detailed on drawings. Must meet ASSE 1070.
BT-1 Bathtub:	Kohler K-20201 bathtub – white, acrylic w/ K-7272 PVC slotted overflow bath drain. Delta T13H933 tub and shower system complete, balanced control valve with blade handle, hand held spray, slide bar, elevated vacuum breaker, and diverting tub fill. After installation is complete, valve shall be adjusted to maximum 110 deg F by a factory trained representative. Provide wood backing in wall for control valve and slide bar.
REF-1 Refrigerator:	Furnished and installed under another Section. Provide in wall behind refrigerator a Sioux Chief OxBox 696 with minirester, angle stop and 10 feet of 1/4" soft copper coiled in box for connection to Refrigerator Ice Maker.
CM-1 Coffee Maker:	Furnished and installed under another Section. Provide in wall above the countertop a

	Brasscraft KTCR19 1/4 turn angle ball stop, escutcheon plate and 10 feet of 1/4" soft copper for connection to coffee maker.
IM-1 Ice Maker:	Furnished and installed under another Section, rough and connect complete. Provide ball valve stop on supply and pipe waste(s) to floor sink. Provide Watts 9D on cold water supply if required by Local Codes. Pipe relief full size to floor sink.
WMB-1 Washing Machine:	Furnish and set in place under another Section. Rough and connect complete. Provide ball valve cut off on hot and cold water supply. Install above ceiling a line size RPZBP with strainer on inlet side of backflow preventer and shock arrestor PDI size "B" on the outlet side. Pipe backflow preventer waste thru factory made air gap down in wall to trench drain.
DW-1 Dishwasher:	Furnished and installed under another Section, rough and connect complete. Provide ball valve stop on supply with shock arrestor PDI size "A" on hot water piping above ceiling.
EWH-1 Electric Water Heater:	Lochinvar LET-40 DJK with a storage capacity of 40 gallons. Set with outlet temperature of 125 deg F. Provide P & T relieve valve and install as detailed on Drawings. 4.5KW, 208/1/60. Verify voltage with Electrical Section. Provide with Holdrite Quick Stand floor stand 40-S-30-U or Quick Stand wall mounted platform 50-SWHP-W.
ET-1 Expansion Tank:	Amtrol Therm - X-Trol #ST-5 expansion tank. Pre-charged, with all wetted internal parts being FDS approved. Isolation between water and air shall be by a Butyl Diaphragm. Provide with 5-year warranty.
RCP-1 Circulator Pump:	Grundfos Model UPS 15-35 SFC. All Bronze. Provide with aquastat controller. 1/12HP 115V/1PH

2.6 ACCEPTABLE MANUFACTURERS

A. Where Kohler is listed above, Toto, Zurn, Mansfield, or American Standard may be substituted.

B. Where Sloan is listed above, Delaney, Toto and Zurn may be substituted.

C. Where J. R. Smith is listed above, Josam, Zurn, Mifab, Watts, Jones Stephens or Wade may be substituted.

D. Where Elkay water coolers are mentioned above, Halsey Taylor, Oasis, Acorn, or Aqua may be substituted, only if water ways are constructed of totally lead free materials.

E. Where Elkay or Franke sink(s) are listed above, Just or Advance Tabco may be substituted.

F. Where Church is listed above, Bemis, Beneke, Centoco, Olsonite or Comfort Seats may be substituted.

G. Where T&S Brass is listed above, Chicago, Speakman, Kohler, Royal, Cambridge, Moen Commercial, or Zurn may be substituted, provided manufacturer can furnish all fixture brass specified.

H. Where Lochinvar tank type water heaters are listed, HTP, Bradford-White, Rheem, or A.O. Smith may be substituted.

I. Where Stern Williams is listed above, Acorn, Fiat, Mustee, or Florestone may be substituted.

J. Where McGuire is listed above for traps, supplies and stops, Kohler, Crane, Eljer, Zurn, Dearborn, or American Standard may be substituted.

K. Where J.R. Smith trap guards are listed above, ProSet and Sureseal may be substituted.

L. Where McGuire ProWrap is listed above, "Handi Lav-Guard" by Truebro, "Trap-Wrap" by Brocar Industries, Inc., Dearborn, or Plumberex may be substituted.

M. Where Amtrol is listed for expansion tanks, John Wood, Watts, ITT-Bell & Gossett, Elbi, or Armstrong may be substituted.

N. Where J.R. Smith is listed for wall hydrants; Woodford, Zurn, Josam, Watts, or Mifab may be substituted.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify all electrical characteristics of electrical motors, starters and equipment with Electrical Drawings. Should the Contractor change the characteristics of the electrical equipment, it shall be the responsibility of the Contractor to coordinate all changes with the other trades and bear all costs of such changes.

B. Coordinate all cutouts in millwork and casework with supplier for proper cutout dimensions.

C. Install all fixtures and equipment in accordance with manufacturer's recommendations.

D. All wall hung fixtures are to be installed on floor mounted fixture supports. Fixture supports are to be anchored to floor with anchors in all mounting holes. Anchors to be sized as per the manufacturer’s recommendations. Seal all fixtures to walls and floor with white silicone sealant. Seal all sinks to counter tops with clear silicone sealant.

E. Adjust all stops, flush valves, and valves for intended water flow rate.

F. Clean plumbing fixtures and equipment and remove tags.

G. Install all electric water heaters with clearance for removal of heating elements.

H. Provide backing in wall for flush valve YJ brackets, faucet supports, etc. Anchor to the backing with anchoring screws of sufficient length to penetrate backing. See Section 220410, Part 3.

I. Provide stops with chrome-plated nipples penetrating wall and cover penetrations with chrome-plated escutcheons. Note: Compression type stops and plastic stems are not acceptable.

END OF SECTION 22 0440

SECTION 23 0010

GENERAL HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Description of General HVAC Administrative and Procedural Requirements which apply to all Division 23 sections.
   1. Definitions.
   2. Abbreviations and Acronyms.
   3. Regulatory Requirements.
   4. Fees, Permits, and Inspections.
   5. Substitutions.
   6. Coordination Drawings.
   7. Submittal Requirements.
   8. Temporary Use of HVAC Equipment.
   9. Products Requirements.
   10. Closeout Documents.
   11. Summary of the Work.
   12. Installer's Qualifications.
   13. Drawing Interpretation and Coordination.
   14. Project/Site Conditions.

1.2 RELATED DOCUMENTS

A. Drawings and General Provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification sections apply to all Division 23 Specification sections.

1.3 RELATED SECTIONS

A. Section 012300 "Alternates" for administrative and procedural requirements for alternates. Coordinate related Division 23 work and modify surrounding work to integrate the work of each Alternate.

B. Section 012500 "Substitutions" for administrative and procedural requirements for substitutions requests post bid and negotiation.

C. Section 013100 "Project Management and Coordination" for administrative and procedural provisions for Building Information Modeling.

D. Section 013300 "Submittal Procedures" for administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

E. Section 015000 "Temporary Facilities and Controls" for temporary use of permeant HVAC equipment.

F. Section 016000 "Product Requirements" for administrative and procedural requirements for selection of products for use in Project; and comparable products.

G. Section 017900 "Demonstration and Training" for instructing Owner's personnel.

H. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual.

I. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

J. Section 017900 "Demonstration and Training" for instructing Owner's personnel.

1.4 DEFINITIONS

A. Approved: When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

B. Directed: A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

C. Indicated: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

D. Furnish: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

E. Install: Operations at Project site include unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

F. Provide: Furnish and install, complete and ready for the intended use.

G. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

H. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

I. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

J. Subsystem: A portion of a system with characteristics similar to a system.

1.5 ABBREVIATIONS AND ACRONYMS

A. AFF: Above Finished Floor.

B. AGA: American Gas Association.

C. AMCA: Air Movement and Control Association International, Inc.

D. ANSI: American National Standards Institute, Inc.

E. ARI: Air-Conditioning & Refrigeration Institute.

F. ASHRAE: American Society of Heating, Refrigeration, and Air Conditioning Engineers.

G. ASME: American Society for Mechanical Engineers.

H. ASTM: American Society of Testing and Materials.

I. MEPFP: Mechanical, Electrical, Plumbing, Fire Protection.

J. MSS: Manufacturers Standardization Society of the Valve and Fitting Industry.

K. NAIMA: North American Insulation Manufacturers Association.

L. NEMA: National Electrical Manufacturers Association.

M. NFPA: National Fire Protection Association.

N. NPS: Nominal Pipe Size.

O. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

P. UL: Underwriters Laboratories, Inc.

1.6 REGULATORY REQUIREMENTS

A. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards, and utility company regulations. Where specific code requirements apply, they shall be included in the job, whether or not specifically shown or elsewhere specified.
1. ADA – Americans with Disabilities Act.
2. ASME B31.9 – Building Services Piping.
3. ASHRAE 15 – Safety Code for Mechanical Refrigeration.
4. ASHRAE 62 – Ventilation for Acceptable Indoor Air Quality.
5. ASHRAE 90.1-2013 – Energy Standard for Buildings Except Low Rise Residential Buildings.
6. NFPA 30 – Flammable and Combustible Liquid Code.
7. NFPA 54 – National Fuel Gas Code.
8. NFPA 70 – National Electrical Code.
9. NFPA 90A – Installation of Air Conditioning and Ventilating Systems.
10. NFPA 101 – Life Safety Code.
11. IBC – International Building Code with Fire, Mechanical, Plumbing and Gas Codes; 2021 Edition.
12. Alabama Boiler and Pressure Vessel Safety Act.
13. Local Health Department.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Fees, Permits, And Inspections
1. All required fees, permits, and inspections of all kind shall be obtained and paid for by the Contractor under the section of the specifications for which they are required.
2. Obtain and pay for all certificates of required inspections, and file certificates with Owner.

1.7 SUBSTITUTIONS

A. Conform to the requirements of Section 012500 "Substitutions."

B. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms will be considered by the Architect provided the correct data is submitted and validation of the reason of the request.

C. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner, which are favorable to the Owner in schedule or dollars, may be considered by the Architect providing the correct data is submitted and validation of the reason of the request.

1.8 COORDINATION DRAWINGS

A. General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of building access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

1.9 SUBMITTAL REQUIREMENTS

A. General: Prepare and submit submittals required by individual Specification Sections under provisions of Section 013300 “Submittal Procedures” and the following:

B. Digital Data Files:
1. Electronic digital data files of the Project drawings may be provided by Engineer for Contractor's use in preparing submittals.
2. Electronic digital data files supplied for use in submittal preparation will be subject to terms and conditions of the Engineer’s Release Form. A signed release form and any payment required must be returned to the Engineer prior to the transmission of electronic digital data files.
3. Electronic digital data file formats may include AutoCAD drawings, Revit converted to AutoCAD drawings, or Revit Model.

C. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Submittals shall be submitted by Section. Do not include products or materials from multiple sections in a single electronic file.
2. Name file with submittal number or other unique identifier, including revision identifier.
a. File name shall use Specification Section number.

D. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.

E. Product Data: Submit to the Architect and obtain his approval of a complete list of materials and equipment that are to be provided under Division 23.
1. List shall be complete with manufacturer’s names, catalog number, dimensions, specifications, rating data, and options utilized. Capacities shall be in the terms specified.
2. Call attention to deviations from specified items as to operation and physical dimensions.
3. Performance curves for equipment such as fans and pumps shall be included.

F. Shop Drawings: Before starting work, submit and obtain approval from Architect of detailed drawings of the following, fully dimensional (including elevations of ductwork and piping) and drawn to 1/4” to 1’-0” scale. Submit electronic file of each drawing in PDF format. Engineer will return electronic copy of marked-up drawings.

1. Ductwork (coordinate diffuser locations with architectural reflected ceiling drawings). See Section 233113 “Metal Ducts.”
2. Mechanical Equipment Rooms: Complete layouts for mechanical equipment rooms showing:
   a. Support column locations.
   b. Location and dimensions of equipment foundation and pads.
   c. Location and dimension of equipment and apparatus including electrical control panels, starters, VFDs, service and coil pull areas.
   d. Coordinate with electrical contractor and indicate electrical equipment location(s) i.e., panels, electrical conduit runs and stubs for motors, code clearances, etc.
   e. Dimensioned floor-drain locations.
   f. Layouts to be based on actual equipment being provided.
3. Equipment piping.
4. Submit complete automatic temperature control system control and power wiring diagrams for approval before installing controls. See Division 23 Section “HVAC Instrumentation and Controls.”

1.10 TEMPORARY USE OF MECHANICAL EQUIPMENT

A. Use of permanent HVAC equipment to provide heat, air conditioning, and ventilation during construction will be permitted subject to compliance of the requirements of Section 015000 “Temporary Facilities and Controls” and the following:
   1. Equipment shall not be started until a written request is submitted by the Contractor and reviewed and approved by the Engineer.
   2. Permanent HVAC system shall not be started until permanent doors and exterior windows are in place and the building is relatively dust free. At a minimum, the floors shall be broom cleaned and drywall finishing and painting complete.
   3. Chillers air handling units, and other equipment specified to have factory supervised start-ups shall have such said start-up.
   4. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
   5. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
   6. Install minimum MERV 8 filters in all air handling units. Change filters as required during construction process. Install scheduled filter elements at completion of construction and prior to testing and balancing of systems.
   7. All return air, outside air and exhaust air openings shall have temporary MERV 8 filter media installed over inlet side of opening and secured airtight there to. Change out filters as required during the construction process. If Contractor does not comply with this requirement, Contractor will be required to clean entire duct system at his expense.
      a. At Contractor’s option, in lieu of filtering OSA, close OSA damper tight. (This option does not apply to 100% outside air units or units with limited capacity return air systems.)
      b. At Contractor’s option, in lieu of filtering return and exhaust grilles, close return air damper(s) tight, off exhaust systems and run air handlers at 100% outside air at reduced air flow.
   8. All components of chilled water and heat production, unitary heating and cooling equipment, and air handlers and associated piping and air distribution system, used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained, and inspected prior to acceptance by the Owner.
      a. Pump Seal Flush: Contractor shall change the pump seal flush line cartridge filter after the system has been flushed and on a regular basis thereafter until Substantial Completion.
   9. Antifreeze shall be installed in all systems for which it is scheduled or specified.

10. Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identified replacements, at no additional cost to the Owner.
   1. All supply, return and exhaust grilles, registers, and diffusers to be cleaned.

C. Warranty dates shall start at Date of Substantial Completion. Provide extended warranty from equipment manufacturers to cover time period between start-up and substantial completion.

1.11 PRODUCT REQUIREMENTS AND COMPATIBLE PRODUCTS

A. Provide products in accordance with Section 016000 “Product Requirements” and the following.

B. Multiple items of similar equipment shall be the product of the same manufacturer.

C. Basis-of-Design Product Specification:
   1. General: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design" including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.
   2. When several manufacturers are named in the specifications, the corresponding products and models made by the specified manufacturers will be accepted and Contractor may base his bid on any one of those products. However, if the Contractor’s bid is based on products other than the scheduled or specified **basis of design**, it shall be understood that there will be no extra cost involved, and the effect on other trades has been included in the Contractor’s proposal. Coordination with other trades for substituted equipment or use of products other than the named basis of design shall be the responsibility of the Contractor.
   3. The basis of design manufacturer’s equipment has been used to determine space requirements. Should another approved manufacturer’s equipment be used in preparing proposals, Contractor shall be responsible for determining that said equipment will fit space allocated. Submission of shop drawings or product data on such equipment shall be considered as indicating that the Contractor has reviewed the space requirements and the submitted equipment will fit the space allocated with due consideration given to access required for maintenance and code purposes.
   4. The basis of design manufacturer’s equipment and scheduled mechanical equipment electrical requirements has been used to coordinate the electrical requirements of the HVAC equipment with the electrical systems serving that equipment.
      a. Contractor shall coordinate the electrical requirements of the equipment actually furnished on this project and provide the power distribution system required by that equipment at no additional cost to the Owner.
      b. Equipment of higher or lower electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at no additional cost to the Owner.
      c. Refer to Section 230053 “Basic HVAC Material and Methods” Article “Coordination” for additional requirements.
   5. Each bidder may submit to the Architect a list of any Comparable Products which he proposes to use in lieu of the equipment or material named in the specifications with a request for the approval of proposed substitutions. To be considered, such requests must be delivered to the office of the Architect no later than 10 days prior to bid due date. The submittal shall include the following:

a. Specific equipment or material proposed for substitution giving manufacturer, catalog, and model number.
b. All performance and dimensional data necessary for comparison of the proposed substitute with the equipment or material specified.
c. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
d. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
e. Evidence that proposed product provides specified warranty.
f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
g. A statement setting forth any changes in other materials, equipment, or Work of other trades that incorporation of the substitute may require.

D. Value Engineering / Value Analysis (VE/VA)
1. If this project undergoes a value engineering or value analysis process, the Contractor/Bidders are required to do the following:
a. If the Contractor's VE or VA offering is based on products other than the scheduled or specified **basis of design**. The Contractor shall inform all trades of the offering so the effect on other trades is included in the General / Mechanical Contractor's proposal. Coordination with other trades for substituted equipment or use of products, other than the named basis of design, shall be the responsibility of the Contractor furnishing the equipment.
b. The Contractor shall be responsible for determining that offered equipment will fit space allocated. Submission of the VE or VA offering shall be considered as indicating that the Contractor has reviewed the space requirements and the equipment will fit in the space allocated with due consideration given to access required for maintenance and code purposes.
c. The burden of proof of the merit of the proposed substitute is upon the proposer.

1.12 CLOSEOUT DOCUMENTS

A. Submit under provisions of Section 017700 "Closeout Procedures" and Section 017839 "Project Record Documents" and the following:

B. Record Drawings:
1. Keep accurate record of corrections, variations, and deviations, including those required by change orders to the HVAC ductwork, HVAC piping, and HVAC control drawings.
2. Accurately show location, size and elevation of new exterior work dimensioned from permanent structure.
3. Record changes daily on a set of prints kept at the job site.
4. Submit prints, marked as noted above, to Architect for review prior to request for final payment.
5. Marked prints will be returned to Contractor for use in preparing Record Drawings.

C. Prior to the issuance of a certificate for final payment, submit to Architect and obtain his approval of one (1) hard copy and electronic files of the following:
1. Record Drawings - sheet metal work. Electronic files in PDF.
2. Record Drawings – piping. Electronic files in PDF.
3. Record Drawings – controls systems.
4. Air Balance Report - (Section 230950 "Testing, Adjusting and Balancing.")

5. Water Balance Report. (Section 230950 “Testing, Adjusting and Balancing.”)
6. Approved Equipment Submittal Data.
7. Equipment operating and maintenance manuals.
8. Equipment warranty dates and guarantees.
9. Pressure vessel certificates.
10. List of Owner’s personnel who have received operating and maintenance instructions.
11. Letter certifying that the cleaning program for the chilled water systems has been completed in accordance with the Specifications. (See Section 232113 “Hydronic Piping.”)
12. Submit factory start-up/field reports for:
    a. Variable frequency drives.
    b. Chillers.
    c. Air handling units.

1.13 SUMMARY OF WORK

A. Scope: Provide all labor, materials, and equipment and services necessary for the completion of all mechanical work shown or specified, except work specified to be done or furnished by others, complete and ready for operation.

1.14 QUALITY ASSURANCE

A. Installer’s Qualifications: Firm experienced in installation of systems similar in size and complexity to those required for this project, plus the following:
1. Acceptable to, or licensed, by manufacturer.
2. Not less than 3 years’ experience with systems.
3. Successfully completed not less than 5 comparable scale projects using systems similar to those on this project.

1.15 DRAWING INTERPRETATION AND COORDINATION

A. Drawings are intended to show size, capacity, approximate location, direction, and general relationship of one phase to another, but not exact detail or arrangement.

B. Do not scale drawings for location of system components. Check all measurements, location of pipe, ducts, and equipment with the detail architectural, structural, and electrical drawings and conditions existing in the field and layout work so as to fit in with ceiling grids, lighting, and other parts.

C. Make minor adjustments in the field, as required to provide the optimum result to facilitate ease of service, efficient operation, and best appearance.

D. Where doubt arises as to the meaning of the Drawings and Specifications, obtain the Architect’s written decision before proceeding with parts affected; otherwise assume liability for damage to other work and for making necessary corrections to work in question.

E. Refer to Architectural drawings for all dimensions and locations of ceiling diffusers.

1.16 PROJECT/SITE CONDITIONS

A. Visiting Site: Visit site and become familiar with location and various conditions affecting this Work. No additional allowance will be granted because of lack of knowledge of unforeseen conditions.

B. Cause as little interference or interruption of existing utilities serving existing facilities as possible. Schedule work which will cause interference or interruption in advance with Owner, authorities having jurisdiction, and all other affected trades.

PART 2 - PRODUCTS – Not Used.

PART 3 - EXECUTION – Not Used.

END SECTION 23 0010

SECTION 23 0053

BASIC HVAC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Description of common piping, equipment, materials, and installation for HVAC systems.

B. This Section includes the following:
1. Low-emitting material requirements.
2. Mechanical sleeve seals.
3. Sleeves.
4. Concrete.
5. Grout.
6. Escutcheons.
7. Access doors - Building.
8. Starters.
9. Workmanship.
10. Excavation, trenching, and backfilling.
11. Equipment installation - Common Requirements.
12. Painting and finishing.
13. Concrete bases.
14. Supports and anchorages.
15. Protection of rotating equipment.
16. Protection and cleaning of equipment and materials.

1.2 RELATED SECTIONS

A. Section 078413 “Penetration Firestopping” for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.

B. Section 017300 "Execution" for cutting and patching procedures.

C. Section 083113 “Access Doors and Frames” for building access doors.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations and equipment mounted at grade.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and within chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 ACTION SUBMITTALS

A. Product Data:
   1. Mechanical sleeve seals.
   2. Escutcheons.
   3. Access doors - building.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation or moisture damage.

C. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture. If pipes do not ship with end caps, cover ends of pipe stored on site with 6 mil plastic.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

E. For ductwork and HVAC equipment, refer to Part 3, Article “Protection and Cleaning of Equipment and Materials.”

1.6 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves and inserts in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate installation of building access doors for HVAC items requiring access that are concealed behind finished surfaces.

D. Electrical Characteristics for HVAC Equipment:
   1. Coordinate electrical system installation to match requirements of equipment actually furnished on this project.
   2. **Include a letter with the respective equipment submittal from the electrical contractor and approved by electrical design consultant, detailing changes to the electrical system required to accommodate changes in the power distribution system required to accommodate HVAC equipment that has different electrical power requirements from that equipment used as basis-of-design, or the power provisions as shown on the Electrical Drawings.**

PART 2 - PRODUCTS

2.1 LOW EMITTING MATERIALS – ADHESIVES AND SEALANTS

A. All adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) must comply with the following requirements as applicable to the project scope:
   1. Adhesives, sealants, and sealant primers must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168 requirements effective July 1, 2005, and rule amendment date of January 7, 2005.
   2. Aerosol adhesives must comply with Green Seal Standard for Commercial Adhesives GS-36 requirements in effect on October 19, 2000.

2.2 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annual space between pipe and sleeve.
   1. Manufacturers:
      a. Calpico, Inc.
      b. Innerlynx, Advance Products & Systems, Inc.
      c. Link-Seal by Thunderline.
      d. Metraflex Co.
      e. Pipeline Seal and Insulator, Inc.
   2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   3. Pressure Plates: Plastic. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Included one for each sealing element.
   5. Provide high temperature and U.L. fire rating at fire rated wall penetrations.

2.3 SLEEVES

A. Galvanized-Steel Sheet: 20-gauge minimum thickness; round tube closed with longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

A. Factory Fabricated Sleeving System:
   1. Basis of Design Manufacturer: HoldRite HydroFlame Pro Series Hollow Sleeves.
   2. General: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer non-metallic (polypropylene) sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket
   3. Provide telescoping and non-telescoping as required.
   4. Provide with Mid-Body Water Seal and “locator whiskers.”

B. Refrigerant Piping: Refer to Section 230183 “Refrigerant Piping” for exterior wall.

C. Sealant: Refer to Section 078413 “Penetration Firestopping” for fire- and smoke-stopping penetration sealant requirements.

D. Stuffing Insulation: Glass fiber type, non-combustible.

2.4 CONCRETE

A. Nominal weight concrete (145 PCF) using Type I Portland Cement, 1-inch maximum size coarse aggregate to provide a minimum 28-day compressive strength of 3000 psi.

2.5 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and non-metallic, dry hydraulic-cement grout.
   1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psi, 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
   1. Finish: Polished chrome plated.

2.7 ACCESS DOORS – BUILDING

A. Refer to Division 8 Section “Access Doors and Frames” for requirements for building access doors.

B. Manufacturers:
   1. Bilco.
   2. Milcor.
   3. Nystrom.

C. Construction:
   1. Door: 14-gauge, cold rolled steel.
   2. Frame: 16-gauge, cold rolled steel of configuration to suit material application.
   3. Hinge: Concealed spring hinge.
   4. Latch: Screwdriver cam latch.
   5. Finish: Phosphate dipped and prime coated.
   6. UL labeled when in fire-rated construction with rating to match construction.
   7. Stainless steel (Type 304) shall be used in ceramic tile or glazed structural tile.

D. Size: 16-inch x 16-inch minimum, as indicated on drawings, or as required to allow inspection, service, and removal of concealed items.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. First class and in accordance with best practice. Work to be orderly, neat, workmanlike in appearance and performed by skilled craftsman.

B. Poor or improper workmanship shall be removed and replaced as directed by the Architect without additional cost to the Owner or design professionals.

3.2 EXCAVATION, TRENCHING AND BACKFILLING

A. Provide trenching, excavation, backfilling necessary for performance of work, including excavation of rock and all other materials which may be encountered in accordance with requirements of Section 311000 “Earth Moving,” and the following.

B. Grade bottom of trenches evenly and excavate bell holes to ensure uniform bearing for the full pipe length. Excavate minimum 6 inches below pipe. Refill cuts below grade with sand.

C. Backfill after inspection by Architect and authorities having jurisdiction. Backfill compacted areas (engineered fill) with sand or fine gravel no less than 95% compactancy. Backfill paved areas with sand or fine gravel compacted to meet requirements of Paving Section. Backfill shall be free of rock, wood, steel, brick, etc. Do not disturb pipe.

D. Refer to Division 23, HVAC Piping and Ductwork Sections for specific bedding and backfill requirements.
   1. The first 6-inches of backfill, above factory, field insulated, cladded, or coated piping and ductwork shall be sand.

E. Restore existing pavement, curbs, sidewalks, sodding, bushes, etc., to match surroundings.

3.3 SLEEVES

A. Sleeves are not required for core-drilled holes.
   1. Exception: In mechanical room floors and other potentially wet areas, provide 4-inch x 4-inch curb or 1-1/2-inch angle ring or square, set in silicone adhesive around penetration. Refer to Section 079200 "Joint Sealants" for sealant materials and installation.

B. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
   1. Cut sleeves to length so that sleeve extends out 1/2-inch from both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas, or other potentially wet areas, 1-1/2-inches above finished floor level. Caulk space outside of sleeves watertight.
   2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
   3. Use the following sleeve materials:
      a. Sleeves for Piping Through Concrete Beams, Concrete Walls, Footings, and Potentially Wet Floors: Steel pipe.
      b. Sleeves for Piping Through Masonry Walls and Gypsum Board Partitions: Steel sheet sleeves1/2-inch larger than pipe or pipe covering. Provide ductile iron sleeves for below grade penetrations.
   4. Factory Fabricated Sleeving System: Install penetration firestopping system to comply with manufacturer's published installation instructions and drawings for products and applications indicated.
   5. Where piping or ductwork penetrates non-rated equipment room wall, floors or roofs outside of a shaft, close off space between pipe or duct and adjacent work with stuffing insulation and caulk airtight.
   6. Above ground, non-rated, exterior wall penetrations: Seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Section 079200 "Joint Sealants" for sealant materials and installation.
   7. Provide for continuous insulation wrapping through sleeve.
   8. Seal space around the outside of sleeves with grout at masonry walls and floors and dry wall mud at gypsum board partitions.

C. Underground, Exterior-Wall Pipe Penetrations: Where below grade pipes enter building above finished floor, install HDPE thermoplastic sleeve with molded-in water-stop (Century-Line Model CS) for openings up to 25-inches in diameter and heavy wall welded or seamless pipe with 2-inch water-stop continuously welded on both sides (Century-Line Model WS) for openings greater than 25-inches in diameter. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals. Wall sleeves not required for core drilled openings.
   1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve flush to face of interior wall. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
   2. Fill void between pipe and sleeve with urethane foam and waterproof around pipe on below grade end.

D. Fire-Rated Penetrations: Where pipes pass through smoke-rated, fire-rated, and fire-resistive floors, walls, and partitions, install appropriately rated sleeves and firestopping sealant. Refer to Section 078413 “Penetration Firestopping” for materials and installation methods.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

D. Install equipment in accordance with manufacturer's instructions. If manufacturer's instructions conflict with Contract Documents, obtain Architect's decision before proceeding.

E. Install equipment to allow right of way for piping installed at a required slope.

F. All equipment shall be firmly fastened in place:
   1. Pad mounted equipment shall be secured to pads using poured in place anchor bolts or cinch anchors.
   2. Vibration isolators shall be secured to floors or pads and equipment shall be bolted to the isolators.

3.5 PAINTING AND FINISHING

A. Except as specified below or noted on the Drawing, requirements for painting of HVAC systems, equipment, and components are specified in Sections 099123 "Interior Painting" and 099113 "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Paint water pipe and insulation downstream of backflow preventor (non-potable water) to termination point, or to connection with mechanical system piping, purple.

D. Shop prime and field paint all miscellaneous steel supports which are not galvanized.

E. Galvanized surfaces damaged during installation shall be repaired with a galvanized repair compound complying with Mil Spec DOD-P-21035B.

3.6 CONCRETE BASES

A. Provide concrete foundations with nominal dimensions conforming to the following schedule for floor-mounted equipment:

Equipment	Foundation
Water-Cooled Chillers	6-inch-high pad
Expansion Tanks	4-inch-high pad
Air Handling Units	8-inch-high pad
Sheet metal plenums	4-inch-high pad
Filter frames	4-inch-high curb
Equipment located in equipment rooms, not listed above	4-inch-high pad or as indicated on the Drawings
Air-cooled condensing units	4-inch-high pad
Packaged air-cooled chiller	6-inch-high pad

B. Outdoor equipment sitting on a large structural pad (e.g., packaged air-cooled chiller), still requires a minimum 6-inch-high level housekeeping pad.

C. Concrete bases shall be continuous and shall have beveled edges and smooth float finish. Concrete bases shall be reinforced with No. 3 bars a maximum of 12-inch on center each way and held in place with dowel rods at each corner anchored in the slab. Dowel rods shall not penetrate through the slab.

D. Roughen and clean exposed slabs before pouring foundations. Apply bonding agent to surfaces in contact.

E. Concrete pads shall extend a minimum of 6-inches beyond the equipment footprint in all directions, including appurtenances, vibration isolators, base elbow supports, and motors.

F. Equipment attached directly to foundations; bases provided with grout holes; and bases consisting of a structural frame shall have voids filled with grout after attachment to foundation. Vertical inline pumps are not to be anchored to concrete base.

G. Fill voids between baseplates and foundations, and level equipment, with grout.

H. For exterior slabs mounted on grade, increase slab thickness as required based on site conditions to maintain level install. Slab height shall not exceed 30-inches above grade.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section 055000 "Metal Fabrications" requirements.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding, comply with:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

3.8 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.9 ACCESS DOORS – BUILDING

A. Provide access doors in wall and inaccessible ceilings to allow access to service and maintain concealed HVAC equipment, dampers, valves, etc.

B. Coordinate installation of access doors with Divisions responsible for Building System in which panels are being installed.

3.10 PROTECTION OF ROTATING EQUIPMENT

A. For this paragraph only, “exposed” shall include being located in a casing, room, or plenum with door large enough to admit a man.

B. All items of equipment with exposed rotating or reciprocating parts shall be provided with appropriate personnel guards. Comply with all OSHA regulations.

C. Belt guards shall be provided on all belt drives. Guard shall have opening for tachometer reading of drive shaft.

D. Design equipment guards for easy access to belts and other items requiring replacement.

3.11 DEDICATED ELECTRICAL SPACE

A. The space equal to the width and depth of the equipment and extending from the floor to a height of 6 feet above the equipment or to the structural ceiling, whichever is lower, shall be dedicated to the electrical installation. No piping, ducts, leak protection apparatus, or other equipment foreign to the electrical installation shall be located in this zone. The area above the dedicated space shall be permitted to contain foreign systems provided protection is installed to avoid damage to the electrical equipment from condensation, leaks or breaks in foreign systems. Every effort shall be made to eliminate foreign systems above equipment to the structural ceiling. If this is not possible, the Contractor shall encase any pipe in a second pipe with a minimum number of joints. Provide 18 gauge (minimum) galvanized, 4 inch (minimum) deep drain pans under piping and ductwork located or passing over electrical equipment. Pipe 1" drain from pan to nearest floor drain. Drain pan shall be adequately supported and constructed to hold 4 inches of water without collapse.

3.12 PROTECTION AND CLEANING OF EQUIPMENT AND MATERIALS

A. Comply with SMACNA "IAQ Guidelines for Occupied Buildings Under Construction," 2nd Edition 2007 (Chapters 3 and 4).

B. Equipment and materials shall be carefully handled, properly stored, and protected from weather, dust-producing procedures, or damage during construction. For equipment stored in the construction area, seal outlets on air handling units with 6-mil plastic sheeting. Stand-alone units (e.g., fan coil units, air terminal units, etc.) shall be wrapped with plastic and sealed with tape. Repair or replace damaged work, materials, and equipment.

C. Take immediate measures to dry any equipment that becomes wet. If any mold growth develops on equipment due to becoming wet, remediate by following procedures approved by U.S. EPA (2001), "Mold Remediation in Schools and Commercial Buildings."

D. At completion of all work, thoroughly clean, exposed materials (duct, pipe, etc.) and equipment and make ready for painting.

E. Refer to Section 233113 "Metal Ducts", Part 3 Article "Duct Cleanliness."

END SECTION 23 0053

SECTION 23 0054

VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes solid-state, PWM, VFD's for speed control of three-phase, squirrel-cage induction motors.

1.2 DEFINITIONS

A. BAS: Building automation system.

B. IGBT: Integrated gate bipolar transistor.

C. LAN: Local area network.

D. PID: Control action, proportional plus integral plus derivative.

E. PWM: Pulse-width modulated.

F. VFD: Variable frequency drive.

G. NRTL: Nationally Recognized Testing Laboratory.

1.3 SUBMITTALS

A. Product Data: For each type of VFD. Include dimensions, mounting arrangements, location for conduit entries, shipping and operating weights, and manufacturer's technical data on features, performance, electrical ratings, characteristics, and finishes.
   1. Include manufacturer’s allowable drive to motor wire length.
   2. Include product data on output filters if filters are required.
   3. Include statement that drive capacities and electrical characteristics have been coordinated to match requirements of equipment being furnished on this project.

B. Shop Drawings: For each VFD.
   1. Include dimensioned drawings, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
      a. Each installed unit's type and details.
      b. Nameplate legends.
      c. Short-circuit current rating of integrated unit.
      d. Listed and labeled for series rating of overcurrent protective devices in combination controllers by an NRTL acceptable to authorities having jurisdiction.
   2. Wiring Diagrams: Power, signal, and control wiring for VFD's. Provide schematic wiring diagram for each type of VFD.

C. Compliance with IEEE 519: VFD manufacturer shall provide calculations, specific to this specific installation, showing the total harmonic voltage distortion is less than 5%. Input line filters shall be provided and sized as required by the VFD manufacturer to ensure compliance with IEEE 519.

D. Coordination Drawings: Drawings to scale, showing dimensioned layout, required working clearances, and required area above and around VFD's and output filters where pipe and ducts are prohibited. Show VFD layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

E. Operation and Maintenance Data: For VFD's, all installed devices, and components to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store VFD's indoors in clean, dry space with uniform temperature to prevent condensation. Protect VFD's from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation, capable of driving full load without derating, under the following conditions, unless otherwise indicated:
1. Ambient Temperature: 0 to 40 deg C (5 deg to 104 deg F).
2. Humidity: Less than 95 percent (noncondensing).
3. Altitude: Not exceeding 3300 feet.
4. Drives located outdoors or in non-air-conditioned mechanical rooms, central plants, etc., shall have a continuous output current rating of 110% of motor nameplate FLA.

1.7 COORDINATION

A. Coordinate layout and installation of VFD's with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate features, accessories, and functions of each VFD and each installed unit with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

C. Coordinate sizing of VFD's to match horsepower, output amps, and electrical characteristic requirements with submittal data for the equipment being provided on this project.

1.8 WARRANTY

A. Special Warranty: Manufacturers standard form in which manufacturer agrees to provide onsite parts and labor warranty for a period of two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB Power Distribution, Inc.; ABB Control, Inc. Subsidiary Series ACH 550.
2. Danfoss Inc.; Danfoss Electronic Drives Div. VTL6000 Series.
3. Emerson Industrial Automation.
4. Rockwell Automation; Allen-Bradley Co.; Industrial Control Group.
5. Siemens Energy and Automation; Industrial Products Division.
6. Square D.
7. Yaskawa Electric America.

2.2 VARIABLE FREQUENCY DRIVES

A. Description: NEMA ICS 2, IGBT, PWM, VFD; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase induction motor by adjusting output voltage and frequency.
   1. Provide unit suitable for operation of premium-efficiency motor as defined by NEMA MG 1.
   2. Plenum rated.

B. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

C. Output Rating: 3-phase; 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.

D. Unit Operating Requirements:
   1. Input ac voltage tolerance of plus or minus 10 percent.
   2. Input frequency tolerance of 60 Hz, plus or minus 6 percent.
   3. Minimum Efficiency: 98 percent at 60 Hz, full load.
   4. Minimum Displacement Primary-Side Power Factor: 98 percent.
   5. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
   6. Starting Torque: 100 percent of rated torque or as indicated.
   7. Speed Regulation: Plus or minus 1 percent.
   8. Input Line Impedance: 5 percent.

E. Isolated control interface to allow controller to follow control signal over an 11:1 speed range.
   1. Electrical Signal: 4 to 20 mA at 24 V.

F. Internal Adjustability Capabilities:
   1. Minimum Speed: 30 percent of maximum rpm.
   2. Maximum Speed: 80 to 100 percent of maximum rpm.
   3. Acceleration: 1 to a minimum of 1800 seconds.
   4. Deceleration: 1 to a minimum of 1800 seconds.
   5. Current Limit: 110 percent of maximum rating.

G. Self-Protection and Reliability Features:
   1. Input transient protection by means of surge suppressors.
   2. Under- and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
   3. Motor Overload Relay: Adjustable and capable of NEMA ICS 2, Class 20 or 30 performance.
   4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
   5. Instantaneous line-to-line and line-to-ground overcurrent trips.
   6. Loss-of-phase protection.
   7. Reverse-phase protection.
   8. Short-circuit protection.
   9. Motor overtemperature fault.
   10. Fast acting drive input fuses.

H. Short Circuit Current Rating: 100 KAIC

I. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.

J. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

K. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

L. Input Line Conditioning: VFD shall have an integral 5% impedance line reactor to reduce the harmonics to the power line. The impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors.

M. VFD Output Filtering: Provide output filters when wire length from drive to motor exceeds manufacturer's allowable length. Filters shall be equal to KLC dv/dt Guard, U.L. Listed, in NEMA 1 enclosure.

N. Status Lights: Door-mounted LED indicators shall indicate the following conditions:
1. Power on – normal operation.
2. Fault.
3. Alarm control

O. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and real time clock.
1. Indicating Devices: Digital LED readout and selector switch, to indicate the following controller parameters:
a. Output frequency (Hz).
b. Motor speed (rpm).
c. Motor status (running, stop, fault).
d. Motor current (amperes).
e. Motor torque (percent).
f. Fault or alarming status (code).
g. PID feedback signal (percent).
h. DC-link voltage (VDC).
i. Set-point frequency (Hz).
j. Motor output voltage (V).

P. Control Signal Interface:
1. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BMS or other control systems:
a. 0 to 10-V dc.
b. 0-20 or 4-20 mA.
c. Potentiometer using up/down digital inputs.
d. Fixed frequencies using digital inputs (Fireman's override).
e. RS485.
f. Keypad display for local hand operation.
3. Output Signal Interface:
a. A minimum of 2 analog output signal (0/4-20 mA), which can be programmed to any of the following:
1) Output frequency (Hz).
2) Output current (load).
3) DC-link voltage (VDC).
4) Motor torque (percent).
5) Motor speed (rpm).

6) Set-point frequency (Hz).

4. Remote Indication Interface: A minimum of 3 dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
   a. Motor running.
   b. Fault and warning indication (overtemperature or overcurrent).
   c. Loss of load condition (broken belt / broken coupling).

Q. Communications: Provide an RS485 interface allowing VFD to be used with an external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFD to be programmed via BAS control. Provide capability for VFD to retain these settings within the nonvolatile memory.
   1. Coordinate requirements with controls diagrams and controls contractor to provide either Johnson Controls N2, Siemens FLN, LonWorks or BACnet MS/TP interface.

R. Integral Disconnecting Means: NEMA AB 1, instantaneous-trip circuit breaker or a NEMA KS 1, fusible switch door interlocked with lockable handle.

S. Bypass Controller (3-Contactor): NEMA ICS 2, full-voltage, nonreversing enclosed controller with across-the-line starting capability in manual-bypass mode. Provide motor overload protection under both modes of operation with control logic that allows common start-stop capability including stop on external safety fault, in either mode.
   1. Provide a manual 3-contactor bypass consisting of a door interlocked main fused disconnect padlockable in the off position, a built-in motor starter and a four position DRIVE/OFF/BYPASS/TEST switch controlling three contactors. In the DRIVE position, the motor is operated at an adjustable speed from the VFD. In the OFF position, the motor and the VFD are disconnected. In the BYPASS position, the motor is operated at full speed from the AC power line and power is disconnected from the VFD so that service can be performed. In the TEST position, the motor is operated at full speed from the AC line power while power is applied to the input of the VFD. This allows the VFD to be given an operational test while continuing to run the motor at full speed in bypass. In case of an external safety fault, a customer supplied normally closed dry contact shall be able to stop the motor whether in DRIVE or BYPASS mode.
   2. Service personnel shall be able to defeat the main power disconnect and open the bypass enclosure without disconnecting power. This shall be accomplished through the use of a specifically designed tool and mechanism while meeting all local and national code requirements for safety.

T. Bypass Controller (2-Contactor with Service Switch):
   1. Factory wired and tested bypass system consisting of a door interlocked, padlockable circuit breaker, output contactor, bypass contactor, and fast acting VFD input fuses. UL Listed motor overload protection shall be provided in both drive and bypass modes.
   2. The bypass enclosure door and VFD enclosure must be mechanically interlocked such that the disconnecting device must be in the “Off” position before either enclosure may be accessed.
   3. The VFD and bypass package shall have a UL listed short circuit current rating (SCCR) of 100,000 amps and this rating shall be indicated on the UL data label.
   4. Drive Isolation Fuses: Fast acting fuses, exclusive to the VFD, shall be provided to allow the VFD to disconnect from the line prior to clearing upstream branch circuit protection.
   5. Motor protection from single phase power conditions in the bypass mode.
   6. The bypass system shall be designed for standalone operation and shall be completely functional in both Hand and Automatic modes even if the VFD has been removed from the system for repair / replacement. Serial communications shall remain functional even with the VFD removed.

7. Serial Communications – the bypass shall be capable of being monitored and / or controlled via serial communications. On-board communications protocols shall include ModBus; Johnson Controls N2; Siemens Building Technologies FLN (P1); and BACnet.
8. The bypass control shall monitor the status of the VFD and bypass contactors and indicate when there is a welded contactor contact or open contactor coil. This failed contactor condition shall be indicated on the bypass LCD display, programmed to fire a Form-C relay output, and / or over the serial communications protocol.
9. The following operators shall be provided:
   a. Bypass Hand-Off-Auto
10. The bypass shall provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in VFD or Bypass mode. The remote start/stop contact shall operate in VFD and bypass modes. The terminal strip shall allow for independent connection of up to four (4) unique safety inputs.

2.3 ENCLOSURES

A. NEMA Type 1 for general purpose interior dry locations.

B. NEMA Type 3R for exterior or damp locations.

C. NEMA Type 12 for industrial use, dust tight and drip tight – interior locations.

2.4 ACCESSORIES

A. Devices shall be factory-installed in controller enclosure, unless otherwise indicated.

B. Current-Sensing, Phase-Failure Relays for Bypass Controller: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage; with adjustable response delay.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Select features of each VFD to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; and duty cycle of motor, controller, and load.

B. Select horsepower rating of controllers to suit motor(s) controlled. For VFD's serving multiple motors, size VFD according to the sum of the RLA's of all motors.

3.2 INSTALLATION

A. Anchor each VFD assembly to steel-channel sills arranged and sized according to manufacturer's written instructions. Attach by bolting.

B. Controller Fuses: Install fuses in each fusible switch.

3.3 CONTROL WIRING INSTALLATION

A. Connect hand-off-automatic switch and other automatic-control devices where applicable.
   1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
   2. Connect selector switches with control circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.4 CONNECTIONS

A. Conduit installation requirements are specified in Division 26 Sections.

B. Ground equipment according to Division 26.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following check-out and start-up services:
   1. Inspect controllers, wiring, components, connections, and equipment installation. For proper operation and installation of VFD, its options and interface wiring to the BAS.
   2. Set field-adjustable switches and circuit breaker trip ranges.
   3. Program step-overs for critical fan speeds.
   4. Report results in writing.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain variable frequency drives. Refer to Division 01.

END OF SECTION 23 0054

SECTION 23 0062

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following hangers and supports for HVAC system piping ductwork and equipment:
   1. Steel pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Metal framing systems.
   4. Insulation couplings, strut mounted.
   5. Fastener systems.
   6. Pipe stands.
   7. Equipment supports.

1.2 RELATED SECTIONS

A. Division 23, Section “HVAC Systems Insulation”: Inserts, shields, and steel pipe saddles at hangers and supports for insulated piping systems.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-58.

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

A. Product Data: For the following:
   1. Steel pipe hangers and supports.
   2. Insulation couplings.
   3. Pipe stands – factory fabricated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
   1. Trapeze pipe hangers. Include Product Data for components.
   2. Metal framing systems. Include Product Data for components.
   3. Pipe stands. Include Product Data for components.
   4. Equipment supports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers:
1. Anvil International, Inc.
2. B-Line Systems, Inc.; a division of Cooper Industries.
3. Empire Industries, Inc.
4. ERICO/Michigan Hanger Co.
5. National Pipe Hanger Corporation.
6. PHD Manufacturing, Inc.

C. Coatings (All Components):
1. General Service Indoors: Electro-plated.
2. Exterior: Electro-plated or hot dipped galvanized.
3. Direct Contact with Copper Pipe: Provide non-metallic plastic coating or utilize copper hangers.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts to retain pipe.

B. Coatings (All Components):
1. Interior Dry Locations: Electro-plated.
2. Exterior and Wet Locations: Electro-plated or high-performance factory applied electro deposition acrylic coating equal to Unistrut Perma-Green III; electro deposition epoxy coating equal to Cooper B-Line; or approved equivalent.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Available Manufacturers:
1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. Unistrut Corp.; Tyco International, Ltd.

C. Coatings (All Components):
1. Interior Dry Locations: Electro-plated.
2. Exterior and Wet Locations: Electro-plated or high-performance factory applied electro deposition acrylic coating equal to Unistrut Perma-Green III; electro deposition epoxy coating equal to Cooper B-Line; or approved equivalent.

2.5 INSULATION COUPLINGS, STRUT-MOUNTED

A. Description: One-piece, tubular sleeve with an internal configuration that supports, secures, and seals tubular insulation and supports copper tubing without crushing the insulation.

B. Available Manufacturers:
1. Klo-Shure, Inc., Series 7.

C. General:
1. Manufactured from high strength TPO plastic suitable for indoor and outdoor use. Material to be UL 2043 classified for use in plenums.
2. ASTM E84 tested for a maximum 25/50 flame spread/smoke developed index.

3. For copper tubing 1/4 to 4-inch.
4. For preformed foamed plastic (elastomeric) and fiberglass insulation 1/2 to 1-1/2-inch wall thickness.
5. Insulation coupling creates a vapor barrier with no requirement for additional wrappings of insulation, tape, or glue.
6. Strut-mounted (Series 7) provided with coupling, clamp halves (with welded fastener and locknut).

D. Coatings (All Components):
1. Interior Dry Locations: Electro-plated.
2. Exterior and Wet Locations: Electro-plated or high-performance factory applied electro deposition acrylic coating equal to Unistrut Perma-Green III; electro deposition epoxy coating equal to Cooper B-Line; or approved equivalent.

2.6 INSERTS

A. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods. Anvil Figure 282.

2.7 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Available Manufacturers:
a. Hilti, Inc.
b. ITW Ramset/Red Head.
2. Anchor rating to be at least 150% of hanger load rating.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Available Manufacturers:
a. Hilti, Inc.
b. ITW Ramset/Red Head.
2. Anchor rating to be at least 150% of hanger load rating.

2.8 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support outdoor and roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
1. Available Manufacturers:
a. ERICO/Michigan Hanger Co.
b. MIRO Industries.
c. Cooper B-Line: Dura-Block.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.
1. Available Manufacturers:
a. MIRO Industries.
b. Cooper B-Line: Dura-Block.

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
   1. Available Manufacturers:
      a. ERICO/Michigan Hanger Co.
      b. MIRO Industries.
      c. Portable Pipe Hangers.
      d. Cooper B-Line: Dura-Block.
   2. Base: Plastic.
   3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
   4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
   1. Available Manufacturers:
      a. Portable Pipe Hangers.
      b. Cooper B-Line: Dura-Block.
   2. Bases: One or more plastic.
   3. Vertical Members: Two or more protective-coated-steel channels.
   4. Horizontal Member: Protective-coated steel channel.
   5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary equipment roof support.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
   1. Use galvanized members and fasteners where installed outside, in fan plenums and areas of high humidity or condensation.
   2. Provide other members with prime coat. Coat prior to installation.

B. Hanger Rods: Mild steel threaded both ends of continuous threaded with an electro-plated coating.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Provide foundations, supports, etc. not specified under other Divisions and as required to mount equipment in a workmanlike and structurally sound manner.

B. Comply with MSS SP-58 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Coatings:
   1. Refer to respective Part 2 Article for coating requirements.

D. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types: (Anvil Figure numbers are given for reference)
   1. Provide copper clad or plastic-coated hangers on bare copper lines.

2. Equipment pipe hanger with vibration isolators as specified under Division 23 "Vibration and Seismic Controls for HVAC Piping and Equipment."
3. Pipe hangers for non-insulated piping 3-inch and smaller: Adjustable swivel ring (MSS Type 10), Anvil Figure No. 69, or adjustable clevis hanger (MSS Type 1) Anvil Figure No. 260.
4. Pipe hangers for insulated piping, all sizes (except for steam condensate, and hot water over 180 deg F): Adjustable, steel clevis hanger (MSS Type 1) Anvil Figure No. 260.
5. Parallel piping graded in same direction may be grouped on trapezes.
6. Pipe stanchion saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.

E. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8) Anvil Figure No. 261: For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
3. Provide all thread rods to support riser clamp a minimum of one inch above top of sleeve. Where pipe anchors are noted on the plans, anchor rods to concrete floor and attach rod to clamp with washer and nuts.

F. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
3. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

G. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18) Grinnell Figure No. 282: For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19) Grinnell Figure No. 92: For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.

b. Medium (MSS Type 32): 1500 lb.
c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

H. Comply with MSS SP-58 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

I. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-58. Provide and install hangers, supports, clamps, and building attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Fastener System Installation:
1. Use powder-actuated fasteners or mechanical-expansion anchors where inserts are omitted and in existing concrete construction.
2. Install powder-actuated fasteners and mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
3. Do not use powder-actuated fasteners in light weight concrete or concrete less than 4 inches thick.

F. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary equipment roof support.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with the following in accordance with Division 23, Section "HVAC Systems Insulation."
   1. Provide insulation insert and shield at hanger and supports.
   2. Provide steel pipe saddles at roller hangers and supports.

N. Insulation Couplings, Strut-Mounted; Insulated Copper Pipe:
   1. All copper pipe and tubing (1/4 to 4-inch) supported by a strut style metal framing system shall be secured to the anchor channel with resilient insulation couplings with metal clamps.
   2. When pipe is insulated with foamed plastic, apply adhesive to end of insulation prior to inserting into the coupling.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports as required to withstand wind load requirements per 2009 IBC Section 1609.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

C. Prime and paint all non-galvanized metal fabrication per the requirements of Division 9 “Painting.”

3.7 SCHEDULES – PIPE HANGERS/SUPPORTS

A. Pipe Hanger/Support Spacing – Standard weight, steel pipe:

Pipe Size (Inches)	Maximum Hanger/Support Spacing (Feet)	Minimum Hanger Rod Diameter (Inches)
1/2 to 1-1/4	7	3/8
1-1/2	9	3/8
2	10	3/8
2-1/2	11	1/2
3	12	1/2
4	14	5/8

B. Pipe Hanger/Support Spacing – Type L, copper:

Pipe Size (Inches)	Maximum Hanger Spacing (Feet)	Minimum Hanger Rod Diameter (Inches)
1/4 to 3/4	5	3/8
1	6	3/8
1-1/4	7	3/8
1-1/2 to 2	8	3/8
2-1/2	9	1/2
3	10	1/2
4	12	1/2

C. Pipe Hanger/Support Spacing – General:
1. Provide additional hangers or supports at concentrated loads such as flanges, valves, specialties, pumps, etc.
2. Provide a hanger or support within 12-inch of each change in direction for pipe sizes 1-1/2 NPS and smaller.
3. Rod size may be reduced by one size for double rod hangers. Minimum rod diameter shall be 3/8-inch.

END OF SECTION 23 0062

SECTION 23 0077

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, including color and letter style.

1.3 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping, unless otherwise noted herein.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. In existing buildings or facilities, coordinate pipe, valve, and equipment labeling to match existing identification methodology, unless otherwise directed by the Architect.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16-inch thick, and having predrilled holes for attachment hardware.
2. Color Coding:

System	Background Color	Letters
Equipment	Black	White

3. Temperatures up to 160 deg F.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4-inch.
5. Minimum Letter Size: Minimum ½-inch high. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless-steel self-tapping screws.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16-inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4-inch.

F. Minimum Letter Size: Minimum 1/2-inch high for viewing distances up to 72-inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information as indicated elsewhere in the Specifications and on the Drawings.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
   1. Colors: Comply with ASME A13.1, unless otherwise indicated.
   2. Lettering: Use piping system terms indicated on the Drawings. Abbreviate only as necessary for each application length.

B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to partially cover circumference of pipe on lines 6-inches outside diameter, including insulation, and smaller; Snap on, on lines over 6-inches outside diameter, including insulation, and secure with nylon straps.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on the Drawings and an arrow(s) indicating flow direction.
   1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions; or as a separate unit on each pipe label to indicate flow direction.
   2. Lettering Size: At least 1-1/4-inches high for 2-1/2-inch and larger pipe outside diameter, including insulation.

D. Following existing labeling color and format in existing buildings, unless otherwise directed by the Architect.

2.4 UNDERGROUND PIPING AND CONDUIT WARNING TAPE

A. Above Metallic Pipe: 3-inch wide for less than 24-inch burial depth and 6-inch wide for more than 24-inch burial; 4 mil polyethylene tape, color coded with contrasting text.

B. Above Non-Metallic Pipe and Conduit: 3-inch wide, 4.5 mil foil tape, color coded with contrasting text. In addition to tape, trace all below grade non-metallic pipe and conduit with a single strand of No. 16 yellow insulated copper wire laid directly on top of pipe prior to covering of pipe. Extend wire above grade and wrap around pipe / conduit at each termination point.

C. Typical Legend: "Caution Chilled Water Line Below."

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of HVAC equipment.

B. Install or permanently fasten labels on starters furnished under this Division.

C. Locate equipment labels where accessible and visible.

3.3 WARNING SIGNS AND LABELS INSTALLATION

A. Write required message on and attach warning tags to equipment and other items where required in the specifications or shown on the Drawings.

B. Label access doors at fire and smoke dampers to read "FIRE DAMPER", "SMOKE DAMPER", or “COMBINATION FIRE/SMOKE DAMPER” respectively.

C. Provide warning sign at each air/dirt separator in closed loop hydronic systems to read: “BLOW DOWN ON A REGULAR BASIS.”

D. Provide warning sign at each disconnect switch served by a remotely located VFD to read: “TURN OFF POWER TO VFD WHEN DISCONNECT SWITCH IS IN OFF POSITION.”

E. For domestic dryers, where the exhaust duct is concealed within the building construction, provide a warming sign to read: “CAUTION, THE NET EQUIVALENT LENGTH OF DRYER VENT FROM THIS LOCATION IS ___ FEET. THE MAXIMUM ALLOWABLE EXHAUST DUCT LENGTH STATED IN THE CLOTHES DRYER’S INSTALLATION INSTRUCTIONS SHALL BE EQUAL TO, OR GREATER THAN THE POSTED EQUIVALENT LENGTH. DO NOT REMOVE OR DEFACE THIS PLACARD.” Contractor to enter the net equivalent feet based on as-built conditions.

3.4 PIPE LABEL INSTALLATION

A. Identify piping specified under this Division in accordance with ANSI/ASME A13.1.

B. Locate pipe labels where piping is exposed, or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows: **(Note: In finished spaces, obtain direction from Architect prior to installing pipe labels.)**

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. Near each change in direction.
5. At access doors, manholes, and similar access points that permit view of concealed piping.
6. Near major equipment items and other points of origination and termination.
7. Spaced at maximum intervals of 20 feet along each run.

C. Pipe Label Color Schedule:

Piping System	Background Color	Letter Color
Chilled-Water	Green	White
Non-Potable Water	Purple	White

D. Heat Traced Pipes: Apply "Electric Traced" signs to outside of thermal insulation jacket.

3.5 UNDERGROUND PIPING AND CONDUIT WARNING TAPE INSTALLATION

A. Install continuously along length of pipe 12 to 18-inches above the pipe, before final backfilling for:

1. Chilled water.

2. Non-potable water.

B. For non-metallic pipe and conduit provide No. 16 yellow insulated wire laid on top of pipe or conduit and extended above grade and tied off to pipe at each point of termination.

END OF SECTION 23 0077

SECTION 23 0122

METERS AND GAGES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following meters and gages for mechanical systems:
   1. Thermometers.
   2. Gages.
   3. Test ports.
   4. Flowmeters.

1.2 RELATED SECTIONS

A. Section 230900 “Instrumentation and Control for HVAC” for turbine and electromagnetic flow meters.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include performance curves.

B. Shop Drawings: Schedule for thermometers, gages, and flowmeters indicating manufacturer's number, scale range, and location for each.

C. Operation and Maintenance Data: For flowmeters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 Articles where titles below introduce lists, the following requirements apply to product selection.
   1. Manufacturers: Subject to compliance with requirements, provide **products** by one of the manufacturers specified.

2.2 DIGITAL VARI-ANGLE THERMOMETERS

A. Manufacturers:
   1. Palmer-Wahl Instruments, Inc.
   2. Trerice, H. O. Co.
   3. Weiss Instruments, Inc.
   4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

B. Case: High impact ABS.

C. Range: -50 to 300 deg F.

D. Display: 3/8” LCD digits.

E. Power: Self-power with 10 LUX lighting.

F. Recalibration: Internal potentiometer.

G. Sensor: Glass passivated thermistor.

H. Stem: Metal for thermowell insertion and of length to suit installation.

I. Connector: Adjustable type, 180 degrees in vertical and 360 degrees in horizontal plane with locking device.

J. Accuracy: 1 percent of reading or 1 deg F, whichever is greater.

K. Outdoor Installation: Provide clear plastic cover.

2.3 PLASTIC-CASE, LIQUID-IN-GLASS THERMOMETERS

A. Manufacturers:
1. Ernst Gage Co.
2. Eugene Ernst Products Co.
3. Marsh Bellofram.
4. Miljoco Corp.
5. Trerice, H.O. Co.
6. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
7. Winters Instruments.

B. Case: Plastic, 9 inches long.

C. Tube: Red or blue reading, mercury or organic liquid-filled, with magnifying lens

D. Tube Background: Satin-faced, non-reflective aluminum with permanently etched scale markings.

E. Window: Glass or plastic

F. Stem: Metal, for thermowell installation and of length to suit installation.

G. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

H. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale.

2.4 THERMOWELLS

A. Manufacturers: Same as manufacturer of thermometer being used.

B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.5 PRESSURE GAGES

A. Manufacturers:
1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
2. Marsh Bellofram.
3. Palmer-Wahl Instruments, Inc.
4. Trerice, H. O. Co.
5. Weiss Instruments, Inc.

B. Direct-Mounted, Dial-Type Pressure Gages:
1. Standard: ASME B40.100.
2. Case: Dry type, stainless steel, 4-1/2 inch diameter.
3. Pressure-Element Assembly: Bourdon tube.
4. Pressure Connection: Brass, with NPS 1/4 bottom-outlet type.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Satin-faced, white coated metal with scale markings.
7. Pointer: Dark-colored metal.
8. Window: Glass or plastic.
9. Ring: Metal.
10. Accuracy: Grade A, plus or minus 1 percent of middle half scale.

11. Vacuum-Pressure Range: 30-inch Hg of vacuum to 15 psig of pressure.
12. Range of Fluids under Pressure: Two times operating pressure.

C. Pressure Gage Fittings:
1. Valves: NPS 1/4 brass or stainless steel, needle, or ball type.
2. Siphons: NPS 1/4 coil or brass tubing, with threaded ends.
3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.6 TEST PORTS

A. Manufacturers:
1. Flow Design, Inc.
2. Peterson Equipment Co., Inc.
3. Sisco Manufacturing Co, Inc.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 300 psig at 200 deg F.

D. Core Inserts: One or two self-sealing rubber valves.
1. Insert material for air, water, oil, or gas service at 20 to 200 deg F shall be CR.
2. Insert material for air or water service at minus 30 to plus 275 deg f shall be EPDM.

2.7 VENTURI FLOWMETERS

A. Manufacturers:
1. Armstrong Pumps, Inc.
2. Flow Design, Inc.
3. Gerand Engineering Co.
4. Preso Meters Corp.

B. Description: Differential-pressure design for installation in piping; with calibrated flow-measuring element, separate flowmeter, hoses or tubing, valves, fittings, and conversion chart compatible with flow-measuring element, flowmeter, and system fluid.

C. Construction: Bronze, brass, or factory-primed steel; with brass fittings and attached tag with flow conversion data.

D. Pressure Rating: 250 psig.

E. Temperature Rating: 250 deg F.

F. End Connections for NPS 2 and Smaller: Threaded.

G. End Connections for NPS 2-1/2 and Larger: Flanged or welded.

H. Flow Range: Flow range of flow-measuring element and flowmeter shall cover operating range of equipment or system served.

I. Permanent Indicators: Suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having 6-inch diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter element.
1. Scale: Gallons per minute (Liters per second).
2. Accuracy: Plus or minus 1 percent between 20 and 80 percent of range.

J. Portable Indicators: Differential-pressure type, calibrated for connected flowmeter element and having two 12-foot hoses, with carrying case.

1. Scale: Gallons per minute (Liters per second).
2. Accuracy: Plus or minus 2 percent between 20 and 80 percent of scale range.

K. Operating Instructions: Include complete instructions with each flowmeter.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install thermometers where shown on the Drawings.

B. Provide the following temperature ranges for thermometers:
1. Domestic Hot Water: 30 to 180 deg F, with 2-degree scale divisions.
2. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions.
3. Chilled Water: 0 to 100 deg F, with 2-degree scale divisions.

3.2 GAGE APPLICATIONS

A. Install pressure gages where shown on the Drawings.

3.3 INSTALLATIONS

A. Install direct-mounted thermometers and adjust vertical and tilted positions.

B. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.

C. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

D. Install needle-valve or ball valve and snubber in piping for each pressure gage for fluids (except steam).

E. Install needle-valve and syphon fitting in piping for each pressure gage for steam.

F. Install flow indicators in piping systems in accessible positions for easy viewing.

G. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.

H. Install flowmeter elements in accessible positions in piping systems.

I. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.

J. Install permanent indicators on walls or brackets in accessible and readable positions.

K. Install connection fittings in accessible locations for attachment to portable indicators.

L. Mount meters on wall if accessible; if not, provide brackets to support meters.

3.4 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

B. Connect flowmeter-system elements to meters.

C. Connect flowmeter transmitters to meters.

D. Ground equipment according to Division 26 Section "Grounding and Bonding."

E. Connect wiring according to Division 26 Section "Conductors and Cables."

3.5 TEST PLUGS

A. Install test plugs in piping systems at all Building Automation System temperature and pressure sensors. Coordinate requirements and locations with Division 23 Section “HVAC Instrumentation and Controls.”

3.6 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 23 0122

SECTION 23 0183

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Refrigerant piping used for air-conditioning applications.

1.2 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-454B:
   1. Suction Lines for Air-Conditioning Applications: 300 psig.
   2. Suction Lines for Heat-Pump Applications: 535 psig.
   3. Hot-Gas and Liquid Lines: 535 psig.

B. Line Test Pressure for Refrigerant R-407C:
   1. Suction Lines for Air-Conditioning Applications: 230 psig.
   2. Suction Lines for Heat-Pump Applications: 380 psig.
   3. Hot-Gas and Liquid Lines: 380 psig.

C. Line Test Pressure for Refrigerant R-410A:
   1. Suction Lines for Air-Conditioning Applications: 300 psig.
   2. Suction Lines for Heat-Pump Applications: 535 psig.
   3. Hot-Gas and Liquid Lines: 535 psig.

1.3 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:
   1. Thermostatic expansion valves.
   2. Solenoid valves.
   3. Hot-gas bypass valves.
   4. Filter dryers.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
   1. Shop Drawing Scale: 1/8-inch equals 1 foot.
   2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.5 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.6 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS FOR REFRIGERANT PIPING

A. Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Brazing Filler Metals: AWS A5.8, Bag1, silver alloy.

2.2 VALVES AND SPECIALTIES

A. Service Valves:
1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

B. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.
1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and ac coil. Coordinate coil electrical requirements with Division 23, Section “HVAC Instrumentation and Controls.”
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.

C. Thermostatic Expansion Valves: Comply with ARI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Superheat: Adjustable.
6. Reverse-flow option (for heat-pump applications).
7. End Connections: Socket, flare, or threaded union.
8. Working Pressure Rating: 450 psig.

D. Moisture/Liquid Indicators:
1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.

E. Replaceable-Core Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated media.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

F. Permanent Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated media.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

G. Receivers: Comply with ARI 495.
1. Comply with UL 207; listed and labeled by an NRTL.
2. Body: Welded steel with corrosion-resistant coating.
3. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
4. End Connections: Socket or threaded.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 275 deg F.

H. Liquid Accumulators: Comply with ARI 495.
1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or threaded.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

2.3 REFRIGERANTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

B. ASHRAE 34, R-454B: Difluoromethane/Tetrafluoroethane.

C. ASHRAE 34, R-407C: Difluoromethane/Pentafluoroethane/1,1,1,2-Tetrafluoroethane.

D. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR ALL REFRIGERANT TYPES

A. Lines NPS 5/8 and Smaller: Copper, Type ACR, annealed-temper ("soft") tubing and wrought-copper fittings with brazed joints.

B. Lines NPS 3/4 and Larger: Copper, Type ACR, drawn-temper ("hard") tubing and wrought-copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

B. Install thermostatic expansion valves as close as possible to distributors on evaporators.
   1. Install valve so diaphragm case is warmer than bulb.
   2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
   3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

C. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

D. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

E. Install receivers sized to accommodate pump-down charge.

3.3 PIPING INSTALLATION

A. Drawings, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited, unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to equipment to allow service and maintenance.

G. Install piping free of sags and bends.

H. Drawn-Temper Tubing: Install fittings for changes in direction.

I. Annealed-Temper ("soft") Tubing: Make changes in directions greater than 30 degrees with pipe/conduit bending tool to avoid crimping of pipe.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Refer to Division 23 Sections "HVAC Instrumentation and Controls" for control wiring and sequence of operation.

L. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

M. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as

specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

N. Install refrigerant piping in protective conduit where installed belowground.

O. Slope refrigerant piping as follows:
1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

P. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Q. Install pipe sleeves at penetrations in exterior walls and floor assemblies.

R. Seal penetrations through fire and smoke barriers according to Division 07 Sections "Through-Penetration Firestop Systems" and “Fire-Resistive Joint Systems.”

S. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

T. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

U. Seal pipe penetrations through exterior walls according to Division 07 Section "Joint Sealants" for materials and methods.

V. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 PIPE JOINT CONSTRUCTION

A. Pipe joints to be constructed in accordance with the requirements of Division 23, Section “Basic HVAC Materials and Methods.”

B. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. For strut-mounted insulated piping, provide Insulation Couplings per the requirements of Division 23, Section “Hangers and Supports for HVAC Piping and Equipment.”

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:
1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately.
   a. Fill system with nitrogen to the required test pressure.
   b. System shall maintain test pressure at the manifold gage throughout duration of test.

c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
d. Remake leaking joints using new materials and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:
1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 23 0183

SECTION 23 0513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
   1. Motor controllers.
   2. Torque, speed, and horsepower requirements of the load.
   3. Ratings and characteristics of supply circuit and required control sequence.
   4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Motors mounted outdoors shall be TEFC. Provide motor end covers/shields, when exposed to direct rain.

D. All pump motors, greater than 5 HP, shall be TEFC.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: NEMA Premium efficient, as defined in NEMA MG 1 for all motors 1 horsepower and larger.

C. Service Factor: 1.15.

D. Multi-speed Motors: Separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Insulation: Class F.

H. Temperature Rise: Matching insulation rating.

I. Code Letter Designation:
   1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
   2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multi-Speed Drive: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by drive manufacturer.
   1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
   2. NEMA Premium-Efficient NEMA Motors, Inverter-Ready: Class B temperature rise; Class F insulation.
   3. Provide a shaft grounding ring. AEGIS SGR bearing protection ring by Electro Static Technology or approved equivalent.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application or as scheduled on the drawings:
   1. Permanent-split capacitor.
   2. Split phase.
   3. Capacitor start, inductor run.
   4. Capacitor start, capacitor run
   5. Electronically commutated.

B. Multi-speed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Pre-lubricated, anti-friction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 0513

SECTION 23 0629

SCROLL WATER CHILLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Packaged, air-cooled, electric-motor-driven, scroll water chillers.

1.2 DEFINITIONS

A. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.

B. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.

C. IPLV: Integrated part-load value. A single number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and referenced to ARI standard rating conditions.

D. kW/Ton: The ratio of total power input of the chiller in kilowatts to the net refrigerating capacity in tons at any given set of rating conditions.

E. NPLV: Nonstandard part-load value. A single number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and intended for operating conditions other than the ARI standard rating conditions.

1.3 SUBMITTALS

A. Product Data: Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
   1. Performance at ARI standard conditions and at conditions indicated.
   2. Performance at ARI standard unloading conditions.
   3. Minimum evaporator flow rate.
   4. Refrigerant capacity of water chiller.
   5. Oil capacity of water chiller.
   6. Fluid capacity of evaporator.
   7. Characteristics of safety relief valves.
   8. Minimum entering condenser-air temperature
   9. Performance at varying capacity with constant design entering condenser-air temperature. Repeat performance at varying capacity for different entering condenser-air temperatures, from design to minimum, in 10 deg F increments.

B. Shop Drawings: Complete set of manufacturer's prints of water chiller assemblies, control panels, sections and elevations, and unit isolation. Include the following:
   1. Assembled unit dimensions.
   2. Weight and load distribution.
   3. Required clearances for maintenance and operation.
   4. Size and location of piping and wiring connections.
   5. Wiring Diagrams: For power, signal, and control wiring.

C. Coordination Drawings: Drawings, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Structural supports.
   2. Piping roughing-in requirements.

3. Wiring roughing-in requirements, including spaces reserved for electrical equipment.
4. Access requirements, including working clearances for mechanical controls and electrical equipment, and tube pull and service clearances.

D. Certificates: For certification required in "Quality Assurance" Article.

E. Source quality-control test reports.

F. Startup service reports.

G. Operation and Maintenance Data: For each water chiller to include in emergency, operation, and maintenance manuals.

H. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. ARI Certification: Certify chiller according to ARI 590 certification program.

B. ARI Rating: Rate water chiller performance according to requirements in ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."

C. ASHRAE Compliance:
1. ASHRAE 15 for safety code for mechanical refrigeration.
2. ASHRAE Guideline 3 for refrigerant leaks, recovery, and handling and storage requirements.
3. ASHRAE/IESNA 90.1 for energy efficiency.

D. ASME Compliance: Fabricate and stamp water chiller heat exchangers to comply with ASME Boiler and Pressure Vessel Code.

E. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Ship water chillers from the factory fully charged with refrigerant and filled with oil.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to provide labor, material and refrigerant to repair or replace components of chillers that fail in materials or workmanship within one (1) year from date of Substantial Completion.

B. Extended Warranties:
1. Complete compressor, parts only.
2. Extended Warranty Period: 2nd through 5th year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PACKAGED AIR-COOLED WATER CHILLERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Carrier Corporation; a United Technologies company.
2. Daikin.
3. Trane.
4. York International Corporation.

B. Chiller Description
   1. The contractor shall furnish and install air-cooled water chiller with scroll compressors as shown as scheduled in the contract documents. The chiller shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

C. Chiller Operation
   1. Chiller shall be able to start and operate in ambient conditions from 0ºF (-18ºC) to 125ºF (52ºF). Wide ambient operation is accomplished with factory installed and tested protection. If field installed wide ambient solution is used, this shall be purchased and installed at contractor expense.
   2. Chiller shall be capable of operating with a leaving solution temperature range 40ºF to 65ºF (4.4 to 20ºC) without glycol.
   3. Chiller shall be capable of starting up with 95ºF (35ºC) entering fluid temperature to the evaporator. Maximum water temperature that can be circulated with the Chiller not operating is 125ºF (52ºC)
   4. Chiller shall provide evaporator freeze protection and low limit control to avoid low evaporator refrigerant temperature trip-outs during critical periods of chiller operation. Whenever this control is in effect, the controller shall indicate that the chiller is in adaptive mode. If the condition exists for more than 30 seconds, a limit warning alarm relay shall energize.
   5. Rapid Restart™ after power restoration. The Chiller shall be capable of starting in 45 seconds.

D. Compressors
   1. Construct chiller using fully hermetic scroll type compressors with R454B optimized and dedicated scroll profile.
   2. Provide direct drive motor cooled by suction gas with only three major moving parts and a completely enclosed compression chamber that leads to increased efficiency.
   3. Each compressor shall have overload protection internal to the compressor.
   4. Each compressor shall include centrifugal oil pump, oil level sight glass, and oil charging valve.
   5. Each compressor will have crankcase heaters installed and properly sized to minimize the amount of liquid refrigerant present in the oil sump during off cycles.

E. Evaporator
   1. The evaporator shall be a high-efficiency, brazed plate-to-plate type heat exchanger consisting of parallel plates. Braze plates shall be stainless steel with copper braze material.
   2. The water side working pressure shall be rated at 150 psig (10.3 bar) and tested at 1.5 times maximum allowable water side working pressure.
   3. The refrigerant side working pressure shall be rated at 460 psig (29.6 bars) and tested at 1.1 maximum allowable refrigerant side working pressure.
   4. Insulate the evaporator with a minimum of 1.25-inch (K=0.28) UV rated insulation. If the insulation is field installed, the additional money to cover material and installation costs in the field should be included in the bid.
   5. Evaporator heaters shall be factory installed and shall protect chiller down to -20ºF (-29ºC). Contractor shall wire separate power to energize heat tape and protect evaporator while chiller is disconnected from the main power.
   6. Provide water drain connection, vent, and fittings. Factory installed leaving water temperature control and low temperature cutout sensors.
   7. Water connections shall be grooved pipe.
   8. Proof of flow shall be provided by the equipment manufacturer, mechanically installed and electrically wired at the factory of origin.
   9. Factory installed cleanable strainer.
   10. Pump package includes: two high-head pumps, VFD, expansion vessels, drainage valves, shut-off valves at entering and leaving connections. The pump package is single point power

integrated into the chiller unit power with a separate factory wired control panel. The control of the pump is integrated into the chiller controller. The chiller controller displays evaporator pump starts and run-times. Freeze protection down to an ambient temperature of -20ºF (-29ºC) is included as standard. The cold parts of the pump package will also be insulated. Designed with one redundant pump, the chiller controls both pumps through a lead/lag and failure/recovery functionality. A variable speed drive is installed in an additional panel to control the pump. The inverter is adjusted upon start up to balance the system flow and head requirements. The purpose is to save on wasted pump energy caused by a traditional balancing valve.

11. The chilled water buffer tank is factory-installed for easy installation at the building site. The tank is engineered for continuous flow and is fully insulated as standard and is designed with freeze protection down to -20ºF (-29ºC). The purpose of the tank is to increase the chilled water circuit inertia, which is necessary with short water loops. A high circuit inertia reduces the compressor's cycling to increase the compressor life span and allow for more precise water temperature accuracy. It also saves energy as compared to hot gas bypass.

F. Fans
   1. Low sound fans shall by dynamically balanced and direct driven.
   2. All condenser fan TEAO motors have permanently lubricated ball bearings and external overload protection.

G. Condenser
   1. The condenser coils shall consist of copper tubes mechanically bonded into plate-type aluminum fins.
   2. The condenser coils shall have an integral sub-cooling circuit and shall be designed for at least 650 psig (44.8 bar) working pressure. Leak tested at 650 psig (44.8 bar).

H. Enclosures/Chiller Construction
   1. Units shall be constructed of a galvanized steel frame with galvanized steel panels and access doors.
   2. Chiller panels, base rails, and control panels shall be finished with a baked-on powder paint. Control panel doors shall have door stays.
   3. Mount starters and Terminal Blocks in a UL 1995 rated weatherproof panel provided with full opening access doors. If a circuit breaker is chosen, it should be a lockable, through-the-door type with an operating handle and clearly visible from outside of chiller indicating if power is on or off.
   4. The coating or paint system shall withstand 500 hours in a salt-spray fog test in accordance with ASTM B117.

I. Chiller Mounted Starter
   1. The starter shall be across-the-line configuration, factory-mounted and fully pre-wired to the compressor motor(s) and control panel.
   2. Unit shall have a single point power connection.
   3. A control power transformer shall be factory-installed and factory-wired to provide unit control power.
   4. Control panel shall be dead front construction for enhanced service technician safety
   5. Unit wiring shall run in liquid-tight conduit.
   6. A molded case standard interrupting capacity circuit breaker shall be factory pre-wired with terminal block power connections and equipped with a lockable external operator handle, making it available to disconnect the chiller from main power.

J. Refrigerant Circuit

1. All chillers shall have two refrigeration circuits, each with two or three (manifolded) compressor on each circuit.
2. Provide for refrigerant circuit:
   a. Liquid line shutoff valve.
   b. Discharge service valve.
   c. Filter.
   d. Liquid line sight glass.
   e. Electronic expansion valve sized for maximum operating pressure.
   f. Charging valve.
3. Full operating charge of R454B and oil.

K. Controls
1. Factory-mounted to the control panel door, the operator interface has an LCD touch-screen display.
2. Display shall consist of a menu driven interface with easy touch screen navigation to organized sub-system reports for compressor, evaporator, and motor information as well as associated diagnostics.
3. The chiller control panel shall provide password protection of all set-points.
4. Chilled water temperature control shall be microprocessor-based, proportional and integral controller to show water and refrigerant temperature, refrigerant pressure, and diagnostics. This microprocessor-based controller is to be supplied with each chiller by the chiller manufacturer.
5. The front of the chiller control panel shall display the following in clear language, without the use of codes, look-up tables, or gauges:
   a. Run time.
   b. Number of starts.
   c. Current chiller operating mode.
   d. Chilled water set point and set point source.
   e. Electrical current limit set point and set point source.
   f. Entering and leaving evaporator water temperatures.
   g. Saturated evaporator and condenser refrigerant temperatures.
   h. Evaporator and condenser refrigerant pressure.
   i. Differential oil pressure.
   j. Phase reversal/unbalance/single phasing and over/under voltage protection.
   k. Low chilled water temperature protection.
   l. High and low refrigerant pressure protection.
   m. Load limit thermostat to limit compressor loading on high return water temperature.
   n. Condenser fan sequencing to automatically cycle fans in response to load, expansion valve pressure, condenser pressure, and differential pressure to optimize chiller efficiency.
   o. Display diagnostics.
   p. Compressors: Status (on/off), %RLA, anti-short cycle timer, and automatic compressor lead-lag.
6. On chiller, mount weatherproof control panel, containing starters, power and control wiring, factory wired with terminal block power connection. Provide primary and secondary fused control power transformer.
7. The chiller controller shall utilize a microprocessor that will automatically take action to prevent chiller shutdown due to abnormal operating conditions associated with evaporator refrigerant temperature, high condensing pressure, and motor current overload.
8. Provide the following safety controls with indicating lights or diagnostic readouts.
   a. Low chilled water temperature protection.
   b. High refrigerant pressure.

c. Loss of chilled water flow.
d. Contact for remote emergency shutdown.
e. Motor current overload.
f. Phase reversal/unbalance/single phasing.
g. Over/under voltage.
h. Failure of water temperature sensor used by controller.
i. Compressor status (on or off)

9. Provide the following operating controls:
   a. A variable method to control capacity in order to maintain leaving chilled water temperature based on PI algorithms. Five-minute solid state anti-recycle timer to prevent compressor from short cycling. Compressor minimum stop-to-start time limit shall be 2 minutes. If a greater than 5-minute start-to-start, or greater than 2-minute stop-to-start timer is included, hot gas bypass shall be provided to ensure accurate chilled water temperature control in light load applications.
   b. Chilled water pump output relay that closes when the chiller is given a signal to start.
   c. Load limit thermostat to limit compressor loading on high return water temperature to prevent nuisance trip outs.
   d. High ambient unloader pressure controller that unloads compressors to keep head pressure under control and help prevent high pressure nuisance trip outs on days when outside ambient is above design.
   e. Compressor current sensing unloader chiller that unloads compressors to help prevent current overload nuisance trip outs.
   f. Low ambient lockout control with adjustable setpoint.
   g. Condenser fan sequencing which adjusts the speed of all fans automatically in response to ambient, condensing pressure and expansion valve pressure differential thereby optimizing chiller efficiency.
10. Provide user interface on the front of the panel. If display is on the inside of the panel, then a control display access door shall be provided to allow access to the display without removal of panels. Provide user interface with a minimum of the following features:
    a. Leaving chilled water setpoint adjustment from LCD input.
    b. Entering and leaving chilled water temperature output.
    c. Pressure output of condenser.
    d. Pressure output of evaporator.
    e. Ambient temperature output.
    f. Voltage output.
    g. Current limit setpoint adjustment from LCD input.
11. The chiller control panel shall provide leaving chilled water temperature reset based upon return water temperature.
12. Digital Communications to BAS system shall consist of a BACnet MS/TP interface via a single twisted pair wiring.
13. The chiller control panel shall provide an alarm relay output that shall energize whenever a fault requiring manual reset is detected by the panel.
14. The chiller control panel shall provide input for leaving chilled water temperature setpoint/chiller demand limit setpoint based upon a 2-10VDC signal from a building automation system.
15. The chiller control panel shall provide an output for chiller Percent Capacity via a 2-10VDC or 4-20mA signal to a building automation system

L. Sound
   1. Acoustics: Manufacturer must provide both sound power and sound pressure data in decibels. Sound pressure data per AHRI 370 must be provided at full load.

2. If manufacturer cannot meet the noise levels, sound attenuation devices and/or barrier walls must be installed to meet this performance level.
3. Provide acoustical treatment for compressor

M. Accessories
1. Chiller shall have full architectural louvers panels.

2.2 PACKAGED REFRIGERANT RECOVERY UNITS

A. Packaged portable unit shall consist of compressor, air-cooled condenser, recovery system, tank pressure gages, filter-dryer, and valving that allows for switching between liquid and vapor recovery mode. Refrigerant recovery unit shall be factory mounted on an ASME-constructed and -stamped refrigerant storage vessel that is sized to hold the full refrigerant charge of the largest water chiller.

2.3 SOURCE QUALITY CONTROL

A. Perform functional test of water chillers before shipping.

B. Factory performance test water chillers, before shipping, according to ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."

C. Factory test and inspect evaporator according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Stamp with ASME label.

D. For water chillers located outdoors, rate sound power level according to ARI 370 procedure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before water chiller installation, examine roughing-in for equipment support, anchor-bolt sizes and locations, piping, and electrical connections to verify actual locations, sizes, and other conditions affecting water chiller performance, maintenance, and operations.
1. Water chiller locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WATER CHILLER INSTALLATION

A. Install water chillers on support structure indicated.

B. Equipment Mounting: Install water chiller on concrete bases using elastomeric pads. Comply with requirements in Division 03 Section "Cast-in-Place Concrete."
1. Minimum Deflection: 1/4 inch.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Maintain manufacturer's recommended clearances for service and maintenance.

D. Charge water chiller with refrigerant if not factory charged and fill with oil if not factory installed.

E. Install separate devices furnished by manufacturer and not factory installed.

3.3 CONNECTIONS

A. Comply with requirements in Division 23 Section "Hydronic Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to chiller to allow service and maintenance.

C. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with pressure gage, flow meter, and drain connection with valve. Make connections to water chiller with a union flange or mechanical coupling.

D. Connect each drain connection with a union and drainpipe and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection if required.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.

C. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
1. Verify that refrigerant charge is sufficient and water chiller has been leak tested.
2. Verify that pumps are installed and functional.
3. Verify that thermometers and gages are installed.
4. Operate water chiller for run-in period.
5. Check bearing lubrication and oil levels.
6. Verify that refrigerant pressure relief device for chillers installed indoors is vented outside.
7. Verify proper motor rotation.
8. Verify static deflection of vibration isolators, including deflection during water chiller startup and shutdown.
9. Verify and record performance of chilled-water flow and low-temperature interlocks.
10. Verify and record performance of water chiller protection devices.
11. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

D. Prepare a written startup report that records results of tests and inspections.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water chillers. Video record the training sessions.

END OF SECTION 23 0629

SECTION 23 0712

HVAC SYSTEMS INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. HVAC Piping Insulation.

B. HVAC Equipment Insulation.

C. Duct Insulation.

D. Jackets and Accessories.

1.2 RELATED SECTIONS

A. Section 230062 “Hangers and Supports for HVAC Piping and Equipment”: Insulation Couplings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance, thickness, and jackets (both factory- and field- applied).
   1. Provide product description, list of materials and thickness for each service and location.
   2. For adhesives and sealants, documentation including printed statement of VOC content.
   3. Thermal hanger inserts and shields.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data; For qualified installer.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing insulation work with minimum 3 years’ experience.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230062 “Hangers and Supports for HVAC Piping and Equipment.”

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate pipe insulation installation and testing of heat tracing.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 insulation application articles for where insulation materials shall be applied. Where more than one insulation material is specified for an application, Contractor may use any of the listed insulation materials for that application.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

2.2 GLASS FIBER, PREFORMED PIPE INSULATION

A. Products: Subject to compliance with the requirements, provide one of the following:
1. Johns Manville; Micro-Lok.
2. Knauf; 1000-Degree Pipe Insulation.
3. Mason Insulation; Alley-K Pipe Insulation.
4. Owens Corning; Fiberglass Pipe Insulation.

B. Insulation: ASTM C547; Type 1, Grade A rigid molded, noncombustible.
1. Glass fibers bonded with a thermosetting resin.
2. 'K' value: ASTM C177, 0.24 at 75 degrees F.
3. Maximum service temperature: 850 degrees F.
4. Maximum moisture absorption: 0.2 percent by volume.

C. Factory-applied jackets:
1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

D. ASJ Jacket:
1. Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Glass-Fiber Adhesive:
1. Comply with MIL-A-3316C, Class 2, Grade A.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 CELLULAR GLASS PIPE INSULATION

A. Products: Subject to compliance with the requirements, provide one of the following:
1. Pittsburg Corning Corporation; Foamglass Super K.

B. Insulation: Preformed Pipe Insulation with factory-applied ASJ or ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
1. 'K' value: 0.29 at 75 degrees F.
2. Minimum service temperature: -450 degrees F.
3. Maximum service temperature: 900 degrees F.
4. Maximum water vapor transmission: 0.00 perm.
5. Maximum moisture absorption: ASTM C240, 0.2 percent by volume.
6. Density: 7.5 lb/cu. ft.
7. Maximum compressive strength: ASTM C240, 87 psi.
8. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

C. Cellular-Glass Adhesive:
1. Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Cellular-Glass Joint Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.

2.4 FOAMED PLASTIC PIPE INSULATION

A. Products: Subject to compliance with the requirements, provide one of the following:
1. Armacell LLC; AP Armaflex AP; AP Armaflex FS (Flame Spread).
2. Aeroflex USA; Aerocel.
3. RBX Corporation; Insul-Tube 180.

B. Insulation: ASTM C534, Type 1; flexible, closed-cell, cellular elastomeric insulation, pre-slit or slip on.
1. 'K' value: ASTM C177; 0.27 at 75 degrees F.
2. Minimum service temperature: -70 degrees F.
3. Maximum service temperature: 220 degrees F.
4. Moisture vapor absorption: ASTM D1056; 5.0 percent by weight.
5. Moisture vapor transmission: ASTM E96; 0.10 perm-inches.
6. Flame/Smoke Spread: ASTME E84; 20/50 Flame/Smoke.
7. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive:
1. Air dried adhesive, compatible with insulation.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Protective Coating/Jacket: Weather resistant, compatible with insulation or aluminum jacket as scheduled in Part 3-Execution.

E. Do not use indoors unless product meets ASTM E-84 flame spread rating of less than 25 and smoke density rating of less than 50.

2.5 FIELD-APPLIED JACKETS – PIPING AND EQUIPMENT

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket:
1. Manufacturers: Subject to compliance with the requirements, provide one of the following:
a. Johns Manville; Zeston.
b. P.I.C. Plastics; FG Series.
c. Proto PVC Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.
2. Jacket: ASTM D1784, one-piece molded type fitting covers and sheet material.
a. Minimum service temperature: 0 degrees F.
b. Maximum service temperature: 150 degrees F.
c. Moisture vapor transmission: ASTM E96; 0.002 perm-inches.
d. Thickness: 20 mil.
e. Connections: Brush on welding adhesive.
f. Color: Off-white, unless scheduled to be color coded.
3. Color: (Speedline)
a. Chilled Water: Light Blue
b. Non-Potable Water: Purple
c. Domestic Cold Water: Pea Green
d. Domestic Hot Water (140F): Dark Gray

e. Domestic Hot Water (120F): Light Gray
f. Domestic Hot Water Return: White

4. Jacket Adhesive: As recommended by jacket material manufacturer.
   a. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
5. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

C. Metal Jacket:
1. Manufacturers: Subject to compliance with the requirements, provide one of the following:
   a. Childers Brand, Specialty Construction Brands, Inc., a business of H.B. Fuller Company; Metal Jacketing Systems.
   b. ITW Insulation Systems; Aluminum Jacketing.
   c. PABCO Metals Corp; Surefit.
   d. RPR Products, Inc.; Insul-Mate.
   e. VMSI.
2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
   a. Factory cut and rolled to size.
   b. Thickness: 0.016-inch sheet.
   c. Finish: 3/16" corrugations.
   d. Joining: Longitudinal slip joints and 2-inch laps.
   e. Factory-Fabricated Fittings: 0.024-inch-thick die shaped fitting covers with factory-attached protective liner.
   f. Metal Jacket Bands: 3/8-inch-wide aluminum.
   g. Vapor Retarder Liner: 3-mil thick, bonded polysurin.
3. Factory-Fabricated Fitting Covers: Same material finish and thickness as jacket. Field fabricate fitting covers only if factory-fabricated not available.

2.6 GLASS FIBER, FLEXIBLE EXTERNAL DUCT WRAP

A. Products: Subject to compliance with the requirements, provide one of the following:
1. Certainteed Corp; Duct Wrap.
2. Johns Manville; Microlite.
3. Knauf Insulation; Duct Wrap.
4. Mason Insulation; Alley Wrap.
5. Owens Corning; All-Service Duct Wrap.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
1. 'K' value: ASTM C518, 0.27 at 75 degrees F.
2. Maximum service temperature: ASTM C411; 250 degrees F.
3. Maximum moisture absorption: ASTM C1104; 5 percent by weight.
4. Density: 1.0 lb/cu.ft.
5. At Contractors option, provide insulation density = 0.75 lb/cu.ft. and increase insulation thickness, as required, to provide installed R-value equal to or greater than insulation with density of 1.0 lb/cu.ft. (e.g. 2.3-inch thick, 0.75 lb/cu.ft. insulation can be substituted for 2.0-inch thick, 1.0 lb/cu.ft. density insulation).

C. Vapor Jacket:
1. FSK: Glass-scrim reinforced laminate of aluminum foil and Kraft paper bound together.
2. Moisture vapor transmission: ASTM E96; 0.02 perm.

D. Vapor Retarder Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, white color.

2.7 GLASS FIBER, RIGID BOARD DUCT INSULATION

A. Products: Subject to compliance with the requirements, provide one of the following:
1. Certainteed Corp; Commercial Board.
2. Johns Manville; 800 Series Spin-Glass.
3. Knauf Insulation; Insulation Glass Board.
4. Mason Insulation; AK Board.
5. Owens Corning; Fiberglass 700 Series.

B. Insulation: ASTM C612; rigid, noncombustible board.
1. 'K' value: ASTM C518, 0.23 at 75 degrees F.
2. Maximum service temperature: ASTM C411; 450 degrees F.
3. Maximum moisture absorption: ASTM C1104; 5 percent by weight.
4. Density: 6.0 lb/cu.ft.

C. Vapor Retarder Jacket:
1. FSK: Glass-scrim reinforced laminate of aluminum foil and Kraft paper bound together.
2. Moisture vapor transmission: ASTM E96; 0.02 perm.

D. Indoor Vapor Retarder Mastic: Vinyl emulsion type acrylic, compatible with insulation, white color.

E. Board Fasteners: Galvanized steel impact-applied or welded mechanical fasteners with press-on heads.

2.8 GLASS FIBER DUCT LINER

A. Products: Subject to compliance with the requirements, provide one of the following:
1. Certainteed Corp; ToughGuard.
2. Mason Insulation; Akousti-Liner.
3. Johns Manville.
4. Knauf Insulation.
5. Owens Corning.

B. Insulation: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."; flexible, noncombustible blanket with acrylic polymer meeting ASTM G21 impregnated surface and edge coat. Air side coating shall be black acrylic, containing an EPA registered antimicrobial agent.
1. 'K' value: ASTM C177 or ASTM C518, maximum .28 at 75 degrees F mean temperature.
2. Maximum service temperature: 250 degrees F.
3. Maximum velocity on coated air side: 5,000 fpm.
4. Minimum noise reduction criteria: ASTM C1071; 0.45 for 1-inch thickness.
5. Density: 1.5 lb/cu.ft.
6. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
a. Fungi and Bacteria Resistance: No growth per ASTM E665, G21, and G22.

C. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2-inches in diameter.

D. Adhesive:
1. Waterproof, ASTM C196 fire-retardant type.
2. Comply with NFPA 90A or NFPA 90B and with ASTM C 916. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Liner Fasteners: Galvanized steel, impact applied or welded with integral or press-on head.

2.9 EXTERNAL DUCT SOUND INSULATION

A. Products: Subject to compliance with the requirements, provide one of the following:
1. Kinetics; KNM-100AL.
2. Great Lakes Textiles; Vina-Flex FF-100 (Basis of Design)

B. Insulation: flexible, mass loaded vinyl barrier faced with a scrim reinforced foil on one side.
1. Barium Sulfate loaded limp vinyl sound barrier.
2. Sound Transmission Loss (TL), in the 2nd through 7th octave bands equal to or greater than 11, 15, 21, 27, 33, and 39 db respectively, when tested per ASTM-E90-09 as a free hanging barrier.
3. Weight: 1 pound/square foot.
4. Thickness: 0.10 -inch.
5. 'K' value: 0.29 at 70-degree F.
6. Maximum Flame Spread = 25 and maximum smoke development = 50 per ASTM E84.

2.10 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Retarder Mastic: Water based; suitable for indoor and jacketed outdoor use on below ambient services.
1. Products:
a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Vimasco Corporation; 749.
2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
b. Eagle Bridges - Marathon Industries; 501.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
d. Mon-Eco Industries, Inc.; 55-10.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.

4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
b. Eagle Bridges - Marathon Industries; 570.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
2. Water-Vapor Permeance: ASTM F 1249,.05 perm 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry. Chilled water pipe and equipment shall be at ambient temperature.
3. Pressure and leak test all piping, ductwork and equipment and obtain review and acceptance prior to the application of insulation.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

3.3 INSTALLATION - GENERAL REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces, free of voids throughout.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of the system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service.

D. Install insulation with longitudinal seams at top of horizontal runs.

E. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

F. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

G. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

H. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch-wide strips of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4-inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2-inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward cl-inching staples along edge at 2-inches o.c.
   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints, and at ends adjacent to pipe flanges and fittings.

I. For above-ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.
   4. Manholes.
   5. Handholes.
   6. Cleanouts.
   7. Flanges and unions

3.4 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install

insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2-inches.
4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION – PIPING INSULATION GENERAL

A. Exposed Piping: Locate insulation and cover seams in least visible locations.

B. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

C. Fit pipe hangers over insulation.

D. Inserts and Shields:

1. Application: Protect insulated piping at hangers and supports with insulation shield. On pipe sizes over 2-inches, provide insert.
2. Insulation Protection Shield: Galvanized steel formed in half circle to fit insulation. Length and gage as follow:
   a. Up to NPS 4: 12-inches long and 22-gauge.
3. Insulation-Insert Material: Water repellent treated, ASTM C533, Type I calcium silicate; or ASTM C552, Type II cellular glass of same thickness and vapor retarder jacket specified for surrounding insulation. Insert shall be a minimum of 2-inches longer than the shield.
4. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
5. For Clevis Hangers: Insert shall cover lower 180 degrees of pipe.
6. Option: At Contractor's option, insert may be factory fabricated Thermal Hanger Shield (insulation insert encased in sheet metal shield) equal to Pipe Shield, Inc. "Insulated Pipe Supports."
7. Steel Pipe Saddles: 12-inch-long steel pipe saddle equal to Anvil Figs. 160-165. Tack weld saddles to pipe, fill interior void with insulation that matches adjoining insulation.

E. Exterior Applications: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.6 GLASS FIBER PIPE INSULATION APPLICATION

A. For insulation with factory-applied jackets on above-ambient surfaces, Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. secure laps with outward-cl-inched staples at 6 -inches o.c.

B. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with PVC fitting covers.

C. For hot piping do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

D. For strut-mounted copper piping (NPS 4 and smaller) systems, provide Insulation Couplings per the requirements of Section 230062 “Hangers and Supports for HVAC Piping and Equipment.”

3.7 CELLULAR GLASS PIPE INSULATION APPLICATION

A. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

B. Apply to piping with all joints tightly fitted to avoid gaps. All joints to be sealed full depth with mastic.

C. Vapor retarder jacket shall have minimum 2-inch lap on longitudinal joints.

D. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

E. Seal end joints with 4-inch-wide butt strips.

F. Seal all laps and butt strips with self-seal or field applied appropriate adhesive.

G. Insulate flanges, valves and fitting with fabricated fitting covers of same material and thickness of adjacent pipe. Securely fasten into place with ½-inch aluminum bands. Finish with glass fab over vinyl acrylic mastic with flooding coat or mastic applied over fabric.

3.8 FOAMED PLASTIC PIPE INSULATION APPLICATION

A. Pipe insulation may be seamless insulation slipped over piping before erection or may be slit longitudinally and installed over erected pipe.

B. Fabricate fittings from mitered sections of pipe insulation.

C. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Exterior Applications: Paint entire insulation with two coats of manufacturer’s approved weather-resistant protective finish, except where scheduled to have an aluminum jacket.

E. For strut-mounted copper piping (NPS 4 and smaller) systems, provide Insulation Couplings per the requirements of Section 230529 “Hangers and Supports for HVAC Piping and Equipment.”

3.9 FIELD-APPLIED JACKET APPLICATION

A. Aluminum Jacket:
   1. Rivet jacketing in place and band with aluminum or stainless-steel bands 12-inches on center.
   2. Finish fittings on aluminum jacketed lines with vinyl acrylic mastic reinforced with glass fab. Provide preformed aluminum insulation covers for outdoor fittings.
   3. For exterior applications, locate jacket seams on bottom side of horizontal pipes and seal end joints with weatherproof sealant recommended by insulation manufacturer.

B. PVC Jackets:
   1. Install with 1-inch overlap at longitudinal seams and end joints.
   2. For horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels.
   3. Seal with manufacturer’s recommended adhesive.

a. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.10 SCHEDULES – PIPING INSULATION

A. General: Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Definitions:
1. Runouts: Runouts to individual terminal units not exceeding 4 feet long. Runouts exceeding 4 feet in length to be insulated same as mains.

C. HVAC Piping
1. Chilled Water Supply and Return, Indoors, Above Grade:
   a. Cellular Glass Pipe Insulation
      1) NPS 2 and smaller: 1-1/2-inch thick.
      2) NPS 2-1/2 and larger: 2-inches thick.
      3) Jacket exposed lines with color coded PVC jacket.
   b. Foamed Plastic Pipe Insulation:
      1) Runouts to Room Fan Coil AC Units: 3/4-inch thick.
2. Chilled Water Supply and Return, Outdoors, Above Grade:
   a. Cellular Glass Pipe Insulation
      1) All pipe sizes: 2-inch thick.
      2) Apply insulation over electric heat trace.
      3) Jacket lines with aluminum jacket.
3. Refrigerant Liquid Lines on Mini Split System, Indoors and Outdoors Above Grade:
   a. Foamed Plastic Pipe Insulation, Indoors Above Grade:
      1) All pipe sizes: 1/2-inch thick.
      2) Coat insulated lines exposed outdoors with Armaflex WB finish or approved equal.
4. AC Unit Drain Lines, Indoors, Above Grade:
   a. Foamed Plastic Pipe Insulation
      1) All pipe sizes: 1/2-inch thick.
5. Non-potable Water Lines Between Backflow Preventer and Connection to System Indoors, Above Grade:
   a. Glass Fiber Pipe Insulation
      1) All pipe sizes: 1-inch thick.
      2) Paint exposed pipe insulation purple.
6. Non-potable Water Lines Outdoors, Above Grade:
   a. Cellular Glass Pipe Insulation
      1) All pipe sizes: 1-inch thick.
      2) Apply insulation over electric heat trace.
      3) Jacket lines with aluminum jacket painted with 1-inch-wide band of purple paint.

3.11 INSTALLATION – EQUIPMENT INSULATION GENERAL

A. Install in accordance with NAIMA Insulation Standards.

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

F. Insulated equipment containing fluids below ambient temperature: Insulate entire system.

G. Finish insulation at supports, protrusions, and interruptions.

H. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

I. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.12 SCHEDULES - EQUIPMENT INSULATION

A. General: Acceptable equipment insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Cold Equipment:

1. Air and Dirt Separator:
   a. Foamed Plastic Insulation: 1-inch thick.
   b. Finish with two coats protective coating.
   c. Install for easy removal of bottom to clean coalescence media.
2. Chiller: Cold Water Surfaces:
   a. Foamed Plastic Insulation: 1-inch thick.
   b. Finish with two coats protective coating painted to match chiller.
   c. Apply to allow easy removal of chiller heads.
3. Chilled Water Expansion Tank:
   a. Foamed Plastic Insulation: 1-inch thick.
   b. Finish with two coats protective coating.
4. Chilled Water Buffer Tank:
   a. Foamed Plastic Insulation: 1-inch thick.
   b. Finish with two coats protective coating.
5. One-shot Combination Chemical Feeder -in chilled Water System:
   a. Foamed Plastic Insulation: 1-inch thick.
   b. Install for easy removal of top to replace filters.
   c. Finish with two coats protective coating.
6. Sidestream Filter -in Chilled Water System:
   a. Foamed Plastic Insulation: 1-inch thick.
   b. Finish with two coats protective coating.
   c. Install for easy removal of top to replace filters.
7. Chilled Water Pumps:
   a. Foamed Plastic Insulation: 1-inch thick.
   b. Applied directly to pump body.
   c. Finish with two coats protective coating painted to match chiller.
8. Strainers -in chilled Water Lines:
   a. Foamed Plastic Insulation: 1-inch thick.
   b. Install for easy removal to service strainer.

9. Flexible Connectors -in chilled Water Lines:
   a. Foamed Plastic Insulation.
   b. Build up insulation to thickness of adjacent pipe insulation. Stagger and seal joints last. Extend insulation 2-inches past joint.
10. Mechanical Joint Couplings -in chilled Water Lines:
   a. Foamed Plastic Insulation 1-inch thick.
   b. Insulation shall extend 2-inches beyond coupling. Build up adjacent sections of insulation so that outer piece is not stretched.

3.13 INSTALLATION – DUCTWORK INSULATION GENERAL

A. General: Acceptable duct insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ductwork conveying air below ambient temperature:
   1. Provide insulation with vapor retarder jackets.
   2. Seal all seams, punctures, and tears with mastic. Do not use pressure sensitive tape.
   3. Continue insulation through non-rated walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system including fittings, joints, flanges, exposed sleeves for fire and combination fire and smoke dampers, flexible connections, and expansion joints.

D. Insulated ductwork conveying air above ambient temperature:
   1. Provide with or without standard vapor retarder jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

3.14 DUCT AND PLENUM LINER APPLICATION

A. Install duct liner in accordance with SMACNA “HVAC Duct Construction Standards.”

B. Duct liner shall be cut to assure overlapped and compressed longitudinal corner joints. Apply liner with coated surface facing the air stream and adhere with 90 percent coverage of adhesive.

C. The liner shall be additionally secured with mechanical fasteners for ducts exceeding 8 -inches interior dimensions:

Velocity	Transversely Around Perimeter	Longitudinally
Up to 2500 FPM	At 4-inches from corners and at intervals not exceeding 12-inches.	At 3-inches from transverse joints and at intervals not exceeding 18 -inches.
From 2501 FPM to 6000 FPM	At 4-inches from corners and at intervals not exceeding 6 -inches.	At 3-inches from transverse joints and at intervals not exceeding 16 -inches.

D. All transverse joints shall have factory-applied edge coating and shall be neatly butted without gaps. Transverse joints, with shop-or field-cuts, shall be coated with adhesive approved by insulation manufacturer. At velocities over 2500 FPM (medium pressure supply air duct), all longitudinal joints shall be coated with adhesive.

E. All exposed leading edges facing the air stream at fan discharge, and at any interval of lined duct preceded by unlined duct, shall have factory-or field-applied edge coating. At velocities above 2500 FPM (medium pressure duct), provide metal nosing that is either channel or ZEE profile, or is

integrally formed from the duct wall, securely installed over transversely oriented liner edges facing the air stream.

F. Seal all punctures, tears, or exposed edges at shop-or field-cuts with adhesive.

G. Duct dimensions shown on drawings are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.15 GLASS FIBER, EXTERNAL DUCT WRAP APPLICATION

A. Apply duct wrap to ducts pulled snug but not so tight as to compress corners more than ¼-inch.

B. Adjacent sections of duct wrap shall be tightly butted with 2-inch stapling flap overlapping. Seams shall be stapled approximately 6 -inches on center with ½ -inch minimum steel outward clinching staples. Seal all seams, punctures, and tears with mastic. **Do not use pressure sensitive tape**.

C. Where rectangular or flat oval ducts are 24-inches width or greater, insulation shall be additionally secured to the bottom of the duct with mechanical fasteners spaced 18 -inches on center, not more than 3-inches from edge to prevent sagging. Seal fasteners with mastic.

D. Cover standing seams, stiffeners, and braces using same blanket insulation with 2-inch jacket lap, staples, and mastic.

E. At fire dampers, smoke dampers and combination fire and smoke dampers, stop insulation at rated walls, and externally insulate exposed sleeve on both sides of wall and seal insulation vapor tight to duct and wall.

F. Stop and point insulation around access and damper operators to allow operation without disturbing wrapping.

G. Lift ductwork off trapeze hangers and insert spacers.

3.16 GLASS FIBER, RIGID BOARD DUCT INSULATION APPLICATION

A. Apply board insulation to duct with mechanical fasteners located 12-inches on center. Seal all joints, fasteners, tears and punctures with glass cloth and mastic.

B. Cover standing seams, stiffeners and bracing with same insulation and seal vapor tight.

3.17 EXTERNAL DUCT SOUND INSULATION APPLICATION

A. Omit any external insulation called for elsewhere in the Specification or on the Drawings and apply 2-inch-thick rigid board fiberglass insulation: Owens-Corning 703.

B. Apply sound insulation to outside of the 2-inch-thick rigid board duct insulation and secure with acrylic-based spray contact adhesive. In addition to the adhesive, provide metal or nylon bands on each side of radial joints and at a maximum of 26 -inches on center. Banding to be snug, but do not compress insulation beneath the barrier.

C. Joints: At all seams, provide a minimum 2-inch overlap of the retarder material. Alternately, the retarder may be butted together at the joints, with the seam covered by a 2-inch-wide piece of retarder material.

3.18 SCHEDULES – DUCT INSULATION

A. Common Duct Insulation Requirements:

1. Do not line supply duct connections to multi-zone AC units, or supply duct transitions to packaged air handlers, WSHP’s, or other fan outlets less than 6 square feet outlet area. Insulate these transitions with 2-inch thick External Duct Wrap.

2. Conical and straight spin-in connections for round ducts at rectangular mains on both lined and externally insulated ducts: 2-inch thick External Duct Wrap. For low pressure ducts, split insulation at damper rod and seal vapor tight.
3. Fire, Smoke and Combination Fire and Smoke Dampers: On internally insulated ducts, stop duct liner at damper sleeve. Do not extend internal insulation through wall, partitions, or floor. Insulate portions of exposed damper sleeve, on both sides of the wall or floor, with 2-inch thick External Duct Wrap and seal insulation to duct and wall vapor tight.
4. Flexible Duct Connections on Indoor Insulated Duct Systems: 2-inch thick External Duct Wrap.
5. Duct exposed to view in finished spaces shall be factory insulated or insulated with duct liner.
6. Factory Insulated Duct: Field insulation not required unless otherwise noted.

B. Medium Pressure Supply Duct (Operating Pressure > 3-inch w.g.):
1. All Sheet Metal Medium Pressure Supply Duct: 2-inch thick External Duct Wrap.

C. Low Pressure Supply Ducts:
1. All Sheet Metal Low Pressure Supply Duct Not Specified to be Lined or Otherwise Insulated: 2-inch thick External Duct Wrap.
2. Headers and return bends on duct mounted coils and air terminal unit heating coils: 2-inch thick External Duct Wrap except where exposed to view in finished spaces, sheet metal enclosure with ½" thick Duct Liner.
3. Supply plenum mounted on top of supply diffusers: 2-inch thick External Duct Wrap.

D. Return Ducts:
1. Rectangular Return Ducts: 1-inch-thick Duct Liner.
2. Rectangular Return Duct, First 10 Feet Nearest AC Unit: 1-inch-thick Duct Liner.
3. Rectangular Runout from Main to Return Grilles on Externally Insulated Return Duct System: 1-inch-thick Duct Liner, maximum length of 4 feet nearest grille.
4. All Sheet Metal Return Duct Not Specified to be Lined or Otherwise Insulated: 2-inch thick External Duct Wrap.
5. Rectangular Transfer Ducts: 1-inch-thick Duct Liner.

E. Plenum at Weather Louvers:
1. Plenums Exposed in Mechanical Rooms, Etc.: 2-inch Rigid Board External Duct Insulation with FSK jacket.
2. Plenums Not Exposed: 2-inch thick External Duct Wrap.

F. Outside Air Ducts:
1. All Sheet Metal Outside Air Duct Not Specified to be Otherwise Insulated: 2-inch thick External Duct Wrap.

G. General Exhaust Ducts:
1. Rectangular Exhaust Ducts for Inline Fans, First 10 Feet Nearest Fan Intake: 1-inch-thick Duct Liner.
2. Exhaust Duct Between Inline Exhaust Fan and Building Exit Point (Weather louver, roof cap, brick vent, etc.): 2-inch thick External Duct Wrap.
3. Rectangular Runouts from Main to Exhaust Grilles: 1-inch-thick Duct Liner, maximum 4-foot length.

H. External Duct Sound Insulation:
1. Extent as shown on drawings.
2. Supply, return, and outside air ducts, from AC unit first 15-feet upstream or downstream into the occupied space.

END OF SECTION 23 0712

SECTION 23 0725

CUSTOM INDOOR AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes variable volume, site-built custom air-handling units with coils for indoor installations.

1.2 SUBMITTAL5S

A. Product Data: For each type of site built custom indoor air-handling unit indicated. Include the following:
   1. Unit dimensions, weights, structural weights, and required clearances.
   2. Fans:
      a. Certified fan-performance curves with system operating conditions indicated.
      b. Certified fan-sound power ratings.
      c. Certified fan-performance ratings with system operating conditions indicated.
      d. Motor ratings, electrical characteristics, and motor and fan accessories.
      e. Specialties and accessories.
      f. Material gages and finishes.
   3. Dampers, including housings and linkages.
   4. Filters with performance characteristics.

B. Shop Drawings:
   1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
   2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
   3. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control reports from manufacturer.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain modular indoor air-handling units through one source from a single manufacturer.

B. Options: Drawings indicate size, profiles, and dimensional requirements of modular indoor air-handling units and are based on the specific system indicated. Refer to Division 01, Section “Product Requirements.”

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

E. ARI Certification: Modular indoor air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.

F. Comply with NFPA 70.

1.4 COORDINATION

A. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.5 WARRANTY

A. Provide complete unit parts warranty for one (1) year from startup.

B. Provide extended parts warranty for fan assembly for five (5) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Climate Craft.
   2. Multistack.
   3. Temtrol.

2.2 GENERAL

A. Units shall be specifically engineered for final assembly at the job site. Units requiring any field disassembly to access the mechanical room are not acceptable. The equipment's cooling, heating, ventilating, and performance shall meet or exceed that shown on the schedule. Tags and decals to aid in service or to indicate caution areas shall be provided. Electrical wiring diagrams shall be attached to the control panel access doors. Operation and Maintenance manuals shall be furnished with each unit.

2.3 CABINET CONSTRUCTION

A. Site Assembled units: Units shall be provided by a manufacturer in the business of producing factory and site assembled custom air handling equipment and shall be specifically engineered for final assembly at the jobsite. Site assembly shall be accomplished using the same procedures and techniques as would be used by the manufacturer in the factory and shall yield the same performance characteristics. Site assembly techniques that negate thermal break or other performance characteristics shall not be accepted.
   1. The installing contractor shall provide technicians for training at the AHU manufacturer’s facility prior to equipment shipment and/or site assembly shall be supervised by a direct employee of the AHU manufacturer or by a manufacturer-certified technician. All unit warranty coverage shall be the same as for a factory assembled unit.
   2. Complete units shall be shipped, broken down into individual panel and component form and all pieces shall be engineered for site assembly with no disassembly required. Dimensions and weights of critical sized components shall be provided at time of project submission, for review by the engineer and contractor.
   3. All AHU components, assembly instructions, gasket, and assembly hardware shall be provided by the AHU manufacturer. Assembly instructions shall include easy-to-follow photo details. These details shall include:
      a. Detailed unit specific assembly instructions with typical photos of assembly for both unit and component installation
      b. List of tools required for field installation
   4. Panel gasket supplied with the unit shall be a high-quality weather resistant closed-cell EPDM sponge rubber. Units relying on field applied caulk for sealing are not acceptable. Units shall be securely assembled using machine bolts. Units relying on sheet metal binding screws for field assembly are not acceptable.
   5. Units shall be accompanied by detailed bills of material for each pallet and crate, pallet check lists, panel maps, parts, construction information, and document check lists. All major components shall be identified to match the bills of material and packing lists

B. Casing deflection shall not exceed L/200 at +12.0 w.g. in all positive pressure sections and -12.0 w.g. in all negative pressure sections where L is defined as the panel span. Panels shall be designed to deflect no more than 1/200 (.0005” per inch) of span under operating design conditions when

measured at the panel span. Casing shall be rated for 1% leakage at 1.5 times the operating pressure with a maximum overall pressure of 12" wc.

C. The unit shall be constructed either of a 10-gauge galvanized C-channel perimeter rail with rail heights selectable from 5" to 12" in 1" increments or tubular steel in rail heights of 5" and 8".

D. Gasket supplied with the unit shall be a high-quality, weather-resistant closed-cell EPDM sponge rubber. Each section shall include a label to aid in proper field assembly. Floors shall be designed to deflect no more than 1/200 of span under operating conditions.

E. Standard Floors
1. Floors shall be fabricated of 16-gauge ~~G-90 galvanized steel)~~ {aluminum treadplate .125 base, 3/16" or .187 over treads. All floor sheets shall be isolated from the base assembly with an EPDM thermal break gasket.
2. Floors shall be insulated with two-part polyurethane water-impervious foam insulation. If glass fiber insulation is used an underfloor liner shall be provided. An underfloor liner shall also be provided when the bottom of the unit is used as an air tunnel, when the unit is outdoors and installed on a roof curb, or where the bottom of the unit is exposed to the outdoors.
3. Underfloor liner shall be fabricated of 20-gauge G-90 galvanized steel.
4. To allow for added protection from ruptured coils or piping, floors in specified section(s) shall include a 1 ¼" floor drain piped through the perimeter base. The drain connection through the perimeter base shall be 1 ¼" MPT stainless steel.

F. Wall and roof panels standard construction
1. Panels shall be 2" thick double-wall construction. Panel joints shall be sealed with an industrial EPDM gasket to form water and airtight seal.
2. Panels shall be individually removable for service without removing the roof or compromising the integrity of the cabinet wall. Panels shall be joined with 5/16" bolts that can be removed and refastened. Panel attachment with screws is not acceptable. All panels shall utilize thermal break construction between the exterior panel and the interior liner and between the panels and the base and roof frames.
3. For long-term durability, exterior panels shall be a minimum 16-gauge G90 galvanized steel
4. Interior liners shall be a minimum 20-gauge G90 galvanized steel smooth. Panel liners shall be of a single-piece construction and attached to the exterior panels with a full thermal break. To allow for cleaning, no fasteners shall be used on the exposed liner surface. Single wall units are not acceptable

G. Wall and roof panels
1. Interior wall and ceiling panels shall be 2" thick double-wall construction. Panel joints shall be sealed with an industrial EPDM gasket to form water and airtight seal.
2. Panels shall be individually removable for service without removing the roof or compromising the integrity of the cabinet wall. Panels shall be joined with 5/16" bolts that can be removed and refastened. Panel attachment with screws is not acceptable. All panels shall utilize thermal break construction between the exterior panel and the interior liner and between the panels and the base and roof frames.
3. Interior liners shall be a minimum 16 or 20-gauge G90 galvanized steel. Panel liners shall be of a single piece construction and attached to the exterior panels with a full thermal break. To allow for cleaning, no fasteners shall be used on the exposed liner surface. Single wall units are not acceptable.
4. Liquidtite, rigid steel or aluminum conduit (LFMC): NEC 350, UL-94V, UL360, ASTM-e162 and ASTM-e662; interlocked steel/aluminum with PVC jacket shall be used throughout.
5. Fittings: Liquidtite: NEMA FB1, UL514B; steel, zinc plated shall be used throughout. Must be UL and C-UL listed

H. Insulation
1. All wall and roof panels shall be insulated with glass fiber insulation with an R value of 4.2/inch.

I. Access doors shall be provided in all sections of the air-handling unit as indicated in the plan documents. Doors shall be sized as shown on plan drawings, shall be a minimum 2" thick with R13 polyurethane foam insulation and shall be double wall construction using the same material type as the corresponding section. Doors shall comply with the requirements of UL 1995 and NFPA 90. The door frame shall be 0.125" extruded 6063-T5 aluminum. Each door shall be mounted with adjustable die cast aluminum hinges. All doors and mounting frames shall incorporate a thermal break design, and the doors shall seal to a replaceable extruded EPDM sponge rubber gasket. Doors shall open against static pressure or shall include a pressure relief feature on the door latch.
1. The door latch assembly shall consist of a roller cam compression arm with a chrome plated steel inner handle and glass fiber/nylon composite outer handle. One {tool operated} {key operated} lock shall be provided on each fan section access door. All doors shall have a minimum of two latches.

J. The entire unit, including walls, roof, doors, joints, and seams shall include thermal break construction. This construction shall be supported by tested performance producing no condensation on the exterior surface when the air tunnel temperature is 50°F DB under the following exterior conditions
1. $(Th - 50) / (Th - Tdp) < 3.4$.
2. Th = Ambient dry bulb temperature (°F) external to housing
3. Tdp = Ambient dew point temperature (°F) external to housing.

2.4 FAN ASSEMBLIES – DIRECT DRIVE FAN ARRAY

A. Fan Arrays shall be direct-drive, non-overloading SWSI plenum fans designed for industrial duty and suitable for continuous operation.
1. Fans shall be arranged in an array using one or more welded structural steel assemblies and shall be of the size and quantity specified in the unit schedule. Screwed or riveted frames are unacceptable. Fan assemblies shall be attached directly to base structural members.
2. Fan wheels shall have a minimum of 12 airfoil blades for superior sound characteristics and shall be constructed of aluminum to reduce rotational weight and vibration. Fan blades shall be extruded aluminum for uniformity and improved vibration characteristics.
3. Each fan and motor assembly shall be independently isolated within the structural assembly using 1-inch deflection spring isolators. Isolators shall be mounted in a three-point arrangement that provides both vertical and horizontal (thrust) isolation and shall not require field adjustment. If hard mounted or rubber in shear is used in place of internal spring isolations, external isolation of the entire unit is required.
4. A fan inertia base shall be provided, or the fan structure shall exceed an equivalence of 2x mass of the total rotating parts of the fan array. Fan and motor assemblies shall be designed such that no natural frequencies exist within the operating RPM range of the fan, eliminating the need for "lockout" frequency settings in the variable speed drive. The purchasing contractor will be responsible for all costs associated with externally isolating any unit that does not include individual fan isolation.
5. All fan arrays shall meet the minimum motor efficiency, maximum brake horsepower and total motor horsepower values scheduled. All fans shall be selected to operate at a point no higher than 90% of the peak static pressure rating as defined by the fan performance curve at the selected operating speed. Manufacturer must ensure maximum fan RPM is below the first critical speed. Fans shall be Class 2 construction.

6. All fan and motor assemblies shall be dynamically balanced by the manufacturer to a maximum allowable vibration of 0.040 inches per second at design RPM and a maximum 0.080 inches per second overall vibration limit to bring the fan balance in conformance to a BV-5 Grade G1 per ANSI/AMCA 204. In addition, the manufacturer shall ensure that no critical frequencies exist in the fan operating range by varying motor speed in 1Hz increments from design RPM to 50% of design RPM

B. Motors
1. Electrical characteristics and horsepower shall be as specified on the project schedule.
2. Motors shall be Premium Efficiency per NEMA MG1 Table 12-12 TEFC type, shall have NEMA Class F insulation, shall meet NEMA Standard MD-1 Inverter Duty rating, and shall be designed to withstand 1600V peak voltage spikes and rise times ≥0.1 microseconds.
3. Motors shall have grease-lubricated ball bearings designed to deliver a minimum L10 life of 250,000 hours at full load and the maximum operating RPM of the associated fan. Grease zerks and spring-loaded grease relief valves shall be provided in each motor to allow easy bearing lubrication without damaging the seals due to over lubrication.
4. For efficient operation in a direct drive application, motors shall be capable of operating greater than 60HZ to at least the design operating speed of the fan.
5. Motors shall be factory wired to a motor control center for connection to a disconnect switch or VFD. The motor control center shall include for each motor circuit a control device providing overload protection, short circuit protection and a manual disconnect means, and all circuits shall be wired to a common main panel terminal block. All motors shall operate at all times and be controlled in unison, maintaining a consistent and uniform airflow pattern over coils, filters, and other devices.
6. Each motor shall be provided with a shaft grounding device to harmlessly bleed potential induced shaft voltages to ground

C. Warranty
1. All rotating parts shall be warranted by the unit manufacturer for a full five (5) years from date of unit start-up.

2.5 FAN ARRAY CONTROLS

A. Fan arrays shall be controlled using a common control signal, such as the duct static control signal, to modulate the fan speed.

2.6 FAN SPEED CONTROL (NON-ECM ARRAYS)

A. Each variable air volume supply and return fan array shall be provided with an individual variable frequency drive as specified under division 23.

B. Each variable air volume supply and return fan array shall be provided with an individual variable frequency drive. Drives shall be remote mounted with adequate ventilation provided. The VFD shall be self-contained, totally enclosed in a NEMA 1 ventilated cabinet and capable of operation between 0- and 40-degrees C. The VFD shall be 95% efficient at 100% rated output power, 60 Hz. The VFD shall be UL listed

2.7 UNT SOUND POWER

A. Fan sound power levels (dB) for the unit shall not exceed values as specified on the equipment schedule.

B. Unit manufacturer shall provide certified inlet, supply and casing radiated, sound power levels based on the final unit configuration

2.8 COILS

A. Provide complete coil section(s) with service access door(s) as shown on the plan drawings. Coil connections shall extend through the section casing for ease of installation. Coil connections must be sealed from both the inside and exterior surfaces of the panel with the sleeve of the inner seal covering the pipe within the depth of the panel, all to minimize leakage and condensation. An integral double wall galvanized stainless steel air seal which completely seals around the coil casing and extends to the unit pressure bearing surface shall be provided. Air seals/safing materials that are mechanically fastened to the inner liner of the cabinet only shall be constructed of 16 gage materials to match the material type in the appropriate section and shall be gasketed and have fasteners every 3 inches.

B. Multiple, “stacked” coil arrangements must be constructed so as to allow independent removal of any coil without the removal of another within the coil bank.

C. All coils shall meet or exceed the capacities specified on the mechanical schedule and all water coil performances shall be certified in accordance with the AHRI Forced Circulation Air Heating and Air-Cooling Coil certification program which is based on AHRI Standard 410. Face velocities shall not exceed those specified on the mechanical schedule.

D. All cooling coil sections shall include a double sloped drain pan constructed from 304L stainless steel. All corners shall be welded watertight. Coils shall rest on stainless steel supports. The pan shall have a minimum pitch of 2" from high point to the bottom of the drain outlet connection, providing at least a 1/8” per foot slope. The drain pan shall be insulated with a 2-part sprayed on polyurethane, water impervious foam. Insulation shall be applied to the entire under side of the drain pan and coil section base assembly. If multiple stacked coils are used, intermediate drain pans are required. Intermediate pans shall be insulated and drained with 3/4” copper down-comers to the main pan.

E. Water coils shall be of a staggered tube design with high efficiency plate-type fins for maximum performance. All coils shall be tested with 400 psig compressed air under clear water. Coils shall be designed to operate at 300 psig internal pressure and up to 250ºF. Tubes shall be 5/8" diameter, seamless 0.020” wall copper, mechanically expanded into full drawn fin collars for a continuous compression bond over the full finned length for high-efficiency performance. Coil casings shall be a minimum of 16-gauge galvanized steel. Coil casing reinforcements shall be required for fin lengths over 42". Coil fins shall be 0.0075" thick aluminum. Coils shall be serviceable using 0.25" M.P.T. drain and vent taps on the supply and return headers. Threaded seamless red brass coil connections shall be brazed to copper supply and return headers

2.9 FILTERS

A. Provide complete filter section(s) with filter racks and service access door(s) as shown on the plan drawings. Holding frames provided for medium efficiency applications will be either upstream or downstream accessible. Holding frames provided for high-efficiency applications will be upstream accessible, only. Holding frames shall be constructed from heavy gauge galvanized steel and shall be equipped with polyurethane foam gaskets. Frames shall be installed with vertical stiffeners and appropriate frame-to-frame sealant to provide a rigid leak-tight assembly. An integral air seal that completely seals around the filter frame assembly and extends to the unit pressure bearing surface shall be provided. Air seals/safing materials that are mechanically fastened to the inner liner of the cabinet only shall be constructed of 16 gage materials to match the material type in the appropriate section and shall be gasketed and have fasteners every 3 inches.

Filter fasteners shall be capable of being installed without the requirement of tools, nuts, or bolts. The holding frame shall be designed to accommodate standard-size filters with the application of the appropriate type of fastener. The filter rack shall be designed to use standard 24”x24” and 12”x24” filters only. Odd-sized filters are not allowed. Holding frame assemblies shall be sized to meet or exceed the face area specified by the mechanical schedule.

B. Angle filter racks shall be provided. Angle racks shall be fabricated from a minimum of 16-gauge galvanized steel. Angle racks shall be applied in medium-sized filter applications and will be either upstream or side accessible. Upstream access filter racks shall have one central access cover per row of filters, centered in the unit for easy access. Side access filter racks over 72" long shall include an angle center reinforcement support. Filter racks shall be sized to meet or exceed the area specified in the mechanical schedule. The filter rack shall be designed to use standard 24”x20” and 12”x20” filters only. Odd-sized filters are not allowed.

C. Gauges
   1. A Magnehelic differential pressure gauge shall be provided factory-installed for measuring the pressure drop across each filter bank-single stage. The gauge shall be a diaphragm-actuated dial type, 4¾" O.D., with white dial, black figures and graduations and pointer zero adjustment.
   2. An inclined differential pressure gauge shall be provided factory installed for measuring the pressure drop across each filter bank-single stage. The gauge shall be liquid filled inclined type with black figures, graduations, and pointer zero adjustment.

D. Medium efficiency pleated filters shall be 2" thick, 30% efficient MERV 8 as rated by ASHRAE Standard 52.1 test methods. Filter media shall be of the non-woven cotton fabric type. The filter shall have an average efficiency of 25-30 %. Filters shall be UL900 Class2 listed .

E. High efficiency, rigid mini-pleat filters shall be 4” deep, totally rigid, and disposable type. Each filter shall consist of water-laid micro-fine fiberglass media formed with closely spaced pleats. The enclosing frame shall be double-walled water-resistant beverage board. The filter media shall have an average efficiency of 65% as rated by ASHRAE Standard 52.1 test methods. Filters shall be UL900 Class 2 listed.

2.10 DAMPERS

A. Mixing box and economizer outdoor air return air openings shall be airfoil low-leak dampers, Damper shall be parallel blade type. The frame shall be fabricated from 16-gauge galvanized steel. The damper shall meet the leakage requirements of ASHRAE Std. 90.1 and of the International Energy Conservation Code by leaking less than 3 CFM/sq. ft. at 1” of static pressure and shall be AMCA licensed as a Class 1A damper.

B. Mixing box and economizer outdoor air, return air openings shall be airfoil low-leak dampers. Damper shall be parallel blade type. Damper frame shall be 0.125” thick aluminum hat channel. Damper shall meet the leakage requirements of ASHRAE Std. 90.1 and of the International Energy Conservation Code by leaking less than 3 CFM/sq. ft. at 1” of static pressure, and shall be tested in accordance with AMCA Standard 500-D

2.11 ELECTRICAL POWER AND CONTROLS

A. Unit operating voltage shall 460V, 3 phase, 60Hz. All wiring and electrical equipment supplied by the manufacturer shall conform to and be installed in accordance with the requirements of UL1995.

Provide copper wires, bus bars, and fittings throughout, except the internal wire of the control transformer may be aluminum if copper termination is provided. Identify power supply terminals with permanent markers. The maximum temperature of terminals shall not exceed 167°F (75°C) when the equipment is tested in accordance with its rating. Wiring shall be run in plated flexible metal conduit.

B. Mount a permanent nameplate on the unit to display the manufacturer, serial number and model number, date of manufacture, horsepower, current rating, and voltage

2.12 UNIT TESTING AND QUALITY CONTROL

A. The fans shall be factory run tested to ensure design integrity and proper RPM. All electrical circuits shall be tested to ensure correct operation before shipment of unit. Units shall pass all quality control checks and be thoroughly cleaned prior to shipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for steam, hydronic, and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Concrete Bases: Install floor mounting units on 8-inch-high concrete bases. See Division 23 Section “Basic HVAC Materials and Methods” for concrete base materials and fabrication requirements.

B. Install modular indoor air-handling units with the following vibration-control devices. Vibration-control devices are specified in Division 23 Section "Mechanical Vibration and Seismic Controls."
   1. Units with Internally Isolated Fans: Secure units to anchor bolts installed in concrete bases.
   2. Floor-Mounted Units: Support on concrete bases using neoprene pads. Secure units to anchor bolts installed in concrete bases.
   3. Floor-Mounted Units: Support on concrete bases using housed-spring isolators. Secure units to anchor bolts installed in concrete bases.

C. Arrange installation of units to provide access space around modular indoor air-handling units for service and maintenance.

D. Equipment assembly to be supervised by a direct employee of the AHU manufacturer or by a manufacturer certified service organization. Provide supervision for as long a period of time as is necessary to ensure proper assembly or onsite training.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to air-handling unit to allow service and maintenance.

C. Connect piping to modular indoor air-handling units mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans using NPS 1-1/4, Type M copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

E. Chilled-Water Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.

F. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connections.

G. Electrical: Comply with applicable requirements in Division 26 Sections for power wiring, switches, and motor controls.

H. Ground equipment according to Division 26 Section “Grounding and Bonding.”

I. Tighten electrical connectors and terminals according to manufacturers’ published torque-tightening values. If manufacturers’ torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installations, including piping and electrical connections.
   1. Leak Test: After installation, fill water and steam coils with water, and test coils and connections for leaks. Repair leaks and retest until no leaks exist.
   2. Charge refrigerant coils with refrigerant and test for leaks. Repair leaks and retest until no leaks exist.
   3. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Prepare test and inspection reports in writing.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Final Checks before Start-Up:
   1. Verify that shipping, blocking, and bracing are removed.
   2. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
   3. Perform cleaning and adjusting specified in this Section.
   4. Disconnect fan drive from motor, verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
   5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
   6. Verify that outdoor- and return-air mixing dampers open and close and maintain minimum outdoor-air setting.
   7. Comb coil fins for parallel orientation.
   8. Verify that proper thermal-overload protection is installed for electric coils.
   9. Install new, clean filters.
   10. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

C. Starting procedures for modular indoor air-handling units include the following:
   1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace fan and motor pulleys as required to achieve design conditions.
   2. Measure and record motor electrical values for voltage and amperage.
   3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing" for air-handling system testing, adjusting, and balancing.

3.7 CLEANING

A. After completing system installation and testing, adjusting, and balancing modular indoor air-handling unit according to manufacturer's written instructions, clean internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain modular indoor air-handling units. Refer to Division 01 Section "Closeout Procedures."

END OF SECTION 23 0725

SECTION 23 0738

MINI SPLIT-SYSTEM AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes mini split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting and may be connected to ducts.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

E. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

D. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

E. Units shall be designed to operate with HCFC-free refrigerants.

1.4 COORDINATION

A. Coordinate size and location of concrete bases for units. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 23 Section "Basic HVAC Materials and Methods."

B. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carrier Air Conditioning; Div. of Carrier Corporation.
   2. Daikin.
   3. Fujitsu General American, Inc.
   4. LG.
   5. Mitsubishi Electronics America, Inc.; HVAC Division.
   6. Hitachi.
   7. Bryant.

2.2 WALL-MOUNTING, EVAPORATOR-FAN COMPONENTS

A. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Fan: Direct drive, centrifugal fan.

D. Fan Motors: Comply with requirements in Division 23 Section "Motors."
   1. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

E. Filters: Permanent, cleanable.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

A. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
   1. Compressor Type: Scroll.
   2. Refrigerant Charge: R454B.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

D. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.

E. Fan: Aluminum-propeller type, directly connected to motor.

F. Motor: Permanently lubricated, with integral thermal-overload protection.

G. Low Ambient Kit: Permits operation down to 10 deg F.

2.4 ACCESSORIES

A. Thermostat: Hard wired to remotely control compressor and evaporator fan, with the following features:
   1. 24-hour time control of system stop and start.
   2. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
   3. Fan-speed selection, including auto setting.

B. Automatic-reset timer to prevent rapid cycling of compressor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install ground-mounting, compressor-condenser components on 4-inch- thick, reinforced concrete base; 4 inches larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 23 Section "Basic HVAC Materials and Methods" Coordinate anchor installation with concrete base.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to unit to allow service and maintenance.

C. Ground equipment per Division 26 Section "Grounding and Bonding."

D. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring, switches, and motor controls.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks per manufacturer's written instructions.

END OF SECTION 23 0738

SECTION 23 0762

UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wall and ceiling heaters with propeller fans and electric-resistance heating coils.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Drawings, elevations, sections, and details.
   2. Location and size of each field connection.
   3. Details of anchorages and attachments to structure and to supported equipment.
   4. Equipment schedules to include rated capacities, operating characteristics, furnished specialties, and accessories.
   5. Location and arrangement of piping valves and specialties.
   6. Location and arrangement of integral controls.
   7. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Drawings, reflected ceiling drawings, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Suspended ceiling components.
   2. Structural members to which unit heaters will be attached.
   3. Method of attaching hangers to building structure.
   4. Size and location of initial access modules for acoustical tile.
   5. Items penetrating finished ceiling, including the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.
   6. Perimeter moldings for exposed or partially exposed cabinets.

D. Samples for Initial Selection: Finish colors for units with factory-applied color finishes.

E. Samples for Verification: Finish colors for each type of cabinet unit heater and wall and ceiling heaters indicated with factory-applied color finishes.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 WALL AND CEILING HEATERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   1. Berko Electric Heating; a division of Marley Engineered Products.
   2. Chromalox, Inc.; a division of Emerson Electric Company.
   3. Indeeco.
   4. Markel Products; a division of TPI Corporation.
   5. Marley Electric Heating; a division of Marley Engineered Products.
   6. QMark Electric Heating; a division of Marley Engineered Products.
   7. Trane.

B. Description: An assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

C. Cabinet:
   1. Front Panel: Stamped-steel louver, with removable panels fastened with tamperproof fasteners.
   2. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.

D. Surface-Mounting Cabinet Enclosure: Steel with finish to match cabinet.

E. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high temperature protection. Provide integral circuit breaker for overcurrent protection.

F. Fan: Aluminum propeller directly connected to motor.
   1. Motor: Permanently lubricated, multispeed. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

G. Controls: Unit-mounted thermostat. Low-voltage relay with transformer kit.

H. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

I. Capacities and Characteristics: See Equipment Schedules on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for electrical connections to verify actual locations before unit heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall boxes in finished wall assembly, seal and weatherproof. Joint-sealant materials and applications are specified in Division 07 Section "Joint Sealants."

B. Install cabinet unit heaters to comply with NFPA 90A.

C. Install propeller unit heaters level and plumb.

D. Suspend unit heaters from structure with all-thread hanger rods and elastomeric hangers. Hanger rods and attachments to structure are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

E. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

F. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding."

B. Connect wiring according to Division 26 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
   3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.5 ADJUSTING

A. Adjust initial temperature set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to one visit to Project during other-than-normal occupancy hours for this purpose.

END OF SECTION 23 0762

SECTION 23 0775

ELECTRIC HEATING CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following electric heating cables:
   1. Self-regulating, parallel resistance.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.
   1. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.

B. Shop Drawings: For electric heating cable. Include drawings, sections, details, and attachments to other work.
   1. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.

E. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   1. Chromalox, Inc.; Wiegard Industrial Division; Emerson Electric Company.
   2. Delta-Therm Corporation.
   3. Easy Heat Inc.
   4. Nelson Heat Trace.
   5. Pyrotenax; a division of Tyco Thermal Controls.
   6. Raychem; a division of Tyco Thermal Controls.
   7. Thermon Manufacturing Co.

B. Heating Element: Pair of parallel No. 16 AWG tinned stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled nonheating leads with connectors at one end

and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.

C. Electrical Insulating Jacket: Flame-retardant polyolefin.

D. Cable Cover: Tinned-copper or Stainless-steel braid, and polyolefin outer jacket with UV inhibitor.

E. Maximum Operating Temperature (Power On): 150 deg F

F. Maximum Exposure Temperature (Power Off): 185 deg F.

G. Capacities and Characteristics:
1. Maximum Heat Output: 5 W/ft.
2. Volts: 120V.
3. Phase: 1.
4. Hertz: 60.

2.2 CONTROLS

A. Refer to Division 23 Sections "HVAC Instrumentation and Controls."

B. Pipe-Mounting Thermostats for Freeze Protection:
1. Remote bulb unit with adjustable temperature range from 30 to 50 deg F.
2. Snap action: open-on-rise, single-pole switch with minimum current rating adequate for connected cable.
3. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.
4. Corrosion-resistant, waterproof control enclosure.

2.3 ACCESSORIES

A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Warning Labels: Refer to Division 23 Section "Mechanical Identification."

C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.
1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.
1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.
2. Ensure surfaces and substrates are level and plumb.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Install the following types of electric heating cable for the applications described:
1. Freeze Protection for Outdoor Pipe: Self-regulating, parallel-resistance heating cable.

3.3 INSTALLATION

A. Install electric heating cable or mats across expansion, construction, and control joints according to manufacturer's written recommendations using cable protection conduit and slack cable to allow movement without damage to cable.

B. Electric Heating Cable Installation for Freeze Protection for Piping:
   1. Install electric heating cables after piping has been tested and before insulation is installed.
   2. Install electric heating cables according to IEEE 515.1.
   3. Install insulation over piping with electric cables according to Division 23 Section "Mechanical Insulation."
   4. Install warning tape on piping insulation where piping is equipped with electric heating cables.

C. Set field-adjustable switches and circuit-breaker trip ranges.

D. Protect installed heating cables, including nonheating leads, from damage.

3.4 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding."

B. Connect wiring according to Division 26 Section "Conductors and Cables."

3.5 FIELD QUALITY CONTROL

A. Testing: Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
   1. Test cables for electrical continuity and insulation integrity before energizing.
   2. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

B. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 23 0775

SECTION 23 0820

DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Backdraft dampers.
2. Barometric and pressure relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Flange connectors.
6. Turning vanes.
7. Duct-mounted access doors.
8. Flexible connectors.
9. Flexible ducts.
10. Duct accessory hardware.

1.2 SUBMITTALS

A. Product Data: For each type of product included in this section.
1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Shop Drawings: For duct accessories. Include drawings, elevations, sections, details, and attachments to other work.
1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances, and method of field assembly into duct systems and other construction. Include the following:
a. Special fittings.
b. Manual volume damper installations.
c. Control damper installations.
d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Duct security bars.
f. Wiring Diagrams: For power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

D. Operation and Maintenance Data: For air duct accessories to be included in operation and maintenance manuals.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

1.4 COORDINATION

A. Coordinate size, quantity, type, and locations of automatic dampers with Division 23, Section "HVAC Instrumentation and Controls."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G90.
   2. Exposed-Surface Finish: Mill phosphatized.

C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

G. Galvanized dampers specified below: Use equivalent stainless-steel dampers in stainless steel ducts and aluminum dampers in aluminum ducts constructed per SMACNA standards.

2.2 BACKDRAFT DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Air Balance Inc.; a division of Mestek, Inc.
   2. American Warming and Ventilating; a division of Mestek, Inc.
   3. Cesco Products; a division of Mestek, Inc.
   4. Duro Dyne Inc.
   5. Greenheck Fan Corporation.
   6. Nailor Industries Inc.
   7. NCA Manufacturing, Inc.
   8. Ruskin Company.
   9. SEMCO Incorporated.
   10. Vent Products Company, Inc.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 3000 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Frame: 0.125-inch-thick extruded aluminum, with welded corners and mounting flange.

F. Blades: Multiple single-piece blades, maximum 6-inch width, 0.070-inch- thick, extruded aluminum with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Extruded vinyl, mechanically locked.

I. Blade Axles:
   1. Material: Metallic.
   2. Diameter: 0.75 inch.

J. Tie Bars and Brackets: Galvanized steel.

K. Bearings: Synthetic sleeve type.

L. Sleeve: Minimum 20-gauge thickness.

2.3 BAROMETRIC RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Air Balance Inc.; a division of Mestek, Inc.
   2. American Warming and Ventilating; a division of Mestek, Inc.
   3. Cesco Products; a division of Mestek, Inc.
   4. Duro Dyne Inc.
   5. Greenheck Fan Corporation.
   6. Lloyd Industries, Inc.
   7. Nailor Industries Inc.
   8. NCA Manufacturing, Inc.
   9. Pottorff; a division of PCI Industries, Inc.
   10. Ruskin Company.
   11. SEMCO Incorporated.
   12. Vent Products Company, Inc.

B. Suitable for horizontal or vertical mounting.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Frame: 0.064-inch thick, galvanized sheet steel, with welded corners and mounting flange.

F. Blades:
   1. Multiple, 0.025-inch-thick, roll-formed aluminum.
   2. Maximum Width: 6 inches.
   3. Action: Parallel.
   4. Balance: Gravity.
   5. Eccentrically pivoted.

G. Blade Seals: Vinyl.

H. Blade Axles: Nonferrous metal.

I. Tie Bars and Brackets:
   1. Material: Galvanized steel**.**
   2. Rattle free with 90-degree stop.

J. Return Spring: Adjustable tension.

K. Bearings: Synthetic.

L. Accessories:
   1. Flange on intake.
   2. Adjustment device to permit setting for varying differential static pressures.

2.4 MANUAL VOLUME DAMPERS - STANDARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Air Balance Inc.; a division of Mestek, Inc.
   2. American Warming and Ventilating; a division of Mestek, Inc.
   3. Greenheck: MBD-10, MBD-15, MBDR-50.
   4. McGill AirFlow LLC.
   5. METALAIRE, Inc.
   6. Nailor Industries Inc.
   7. Ruskin Company: MD-25, MD-35, MDRS-25.
   8. Vent Products Company, Inc.

B. Standard leakage rating, with linkage concealed in frame.

C. Suitable for horizontal or vertical applications.

D. Galvanized dampers specified below: Use equivalent stainless-steel dampers in stainless steel ducts and aluminum dampers in aluminum ducts constructed per SMACNA standards.

E. Dampers up to 36x12 inches with a maximum velocity of 1500 fpm (457m/min)
   1. Basis of Design: Ruskin MD25.
   2. Frames:
      a. Hat-shaped, galvanized steel channels, 22-gauge minimum thickness.
      b. Mitered and welded corners.
      c. Flangeless frames for installing in ducts.
   3. Blades:
      a. Single blade.
      b. Stiffen damper blades for stability.
      c. Galvanized steel, 22 gauge thick.
   4. Blade Axles: Galvanized steel.
   5. Bearings:
      a. Molded synthetic.
   6. Tie Bars and Brackets: Galvanized steel.
   7. Actuator: Locking hand quadrant with ½ inch round or 3/8-inch square shaft.

F. Dampers up to 48x48 inches with maximum velocity = 1500 fpm.
   1. Basis of Design: Ruskin MD35.
   2. Frames:
      a. Hat-shaped, galvanized steel channels, 20-gauge minimum thickness.
      b. Mitered and welded corners.
      c. Flangeless frames for installing in ducts.
   3. Blades:
      a. Multiple blade.
      b. Opposed-blade design.
      c. Stiffen damper blades for stability.
      d. Galvanized steel 16 gauge thick.
   4. Blade Axles: Galvanized steel.
   5. Linkage: Concealed in frame.
   6. Bearings:
      a. Molded synthetic.
   7. Tie Bars and Brackets: Galvanized steel.
   8. Actuator: Locking hand quadrant for ½ inch round shaft.

G. Dampers up to 16-inch diameter with a maximum velocity of 1500 fpm
   1. Basis of Design: Ruskin MDRS25.
   2. Frames:
      a. Galvanized steel, 20-gauge minimum thickness.
      b. Roll formed with stiffener beads each end.
      c. Flangeless frames for installing in ducts.
   3. Blades:
      a. Butterfly type.
      b. Stiffen damper blades for stability.
      c. Galvanized steel 20 gauge thick.
   4. Blade Axles: Galvanized steel.
   5. Bearings:
      a. Molded synthetic.
   6. Actuator: Locking hand quadrant for ½ inch round or 3/8 inch for square shaft.

H. Accessories:
   1. Hand Quadrant Standoff Bracket: 2-inch standoff for externally insulated ductwork.

2.5 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Warming and Ventilating; a division of Mestek, Inc.
   2. Arrow United Industries; a division of Mestek, Inc.
   3. Cesco Products; a division of Mestek, Inc.
   4. Duro Dyne Inc.
   5. Greenheck Fan Corporation.
   6. Nailor Industries Inc.
   7. NCA Manufacturing, Inc.
   8. Ruskin Company.
   9. Vent Products Company, Inc.
   10. Young Regulator Company.

B. Low-leakage rating and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:
   1. Hat shaped.
   2. Extruded aluminum channels, 0.064 inch thick.
   3. Mitered and welded corners.

D. Blades:
   1. Multiple blade with maximum blade width of 8 inches.
   2. Parallel- and opposed-blade design.
   3. Extruded aluminum.
   4. 0.064 inch thick.
   5. Blade Edging: Closed-cell neoprene edging.

E. Blade Axles: 1/2-inch- diameter; nonferrous metal; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
   1. Operating Temperature Range: From minus 40 to plus 200 deg F.

F. Bearings:
   1. Molded synthetic.

2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.6 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ruskin Company.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gauge and Shape: Match connecting ductwork.

2.7 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. SEMCO Incorporated.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

D. Vane Construction: Single wall for ducts up to 18 inches high or maximum velocity of 1500 fpm and double wall for larger dimensions or velocities and all medium pressure supply duct.

2.8 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cesco Products; a division of Mestek, Inc.
2. Ductmate Industries, Inc.
3. Flexmaster U.S.A., Inc.
4. Greenheck Fan Corporation.
5. McGill AirFlow LLC.
6. Nailor Industries Inc.
7. Pottorff; a division of PCI Industries, Inc.
8. Ventfabrics, Inc.
9. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
1. Door:
   a. Double wall.
   b. Galvanized sheet metal with 1-inch-thick insulation fill.

c. Latches: Cam latches – plated steel with galvanized steel strikes.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Latches:
a. Access Doors Less Than 12 Inches Square: Two sash latches.
b. Access Doors 12-18 Inches Square: Four sash latches.

C. Round Duct Access Door:
1. Basis of Design: Ruskin ADR.
2. Door:
a. Oval shape, double skin.
b. Galvanized steel with poly-insulation; 22 gauge for 10x6 inch door size; 20 gauge for 16x12 inch door size.
c. Latches: Compression with two hand knobs.
d. Seal: Insert neoprene gasket.
3. Leakage: Airtight to 20-inch W.G.

2.9 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the wrap and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Electrical Grounding
1. Install braided copper jumpers around all flexible connectors.

2.10 FLEXIBLE DUCTS

A. Insulated Flexible Duct, Low Pressure: Installed Downstream of Air Terminal Units and Low-Pressure AC Units.
1. Manufacturers:
a. Atco Rubber Products; 30 Series.
b. Flexmaster: Type 5 (Basis of Design).
c. Thermaflex: M-KE.
2. UL 181, Class 1, trilaminate of aluminum foil, fiberglass, and aluminized polyester mechanically locked (no adhesives) to a helically wound galvanized steel wire, fiberglass insulation, black polyethylene vapor-barrier.
3. Vapor Barrier Permeance: 0.1 perm per ASTM E96, procedure A.
4. Pressure rating: 6-inch WG positive and 4-inch WG through 16-inch diameter.
5. Temperature Range: Minus 20 to plus 210 deg F.
6. Thermal Performance: R-value not less than 4.2 per ASTM C-518.

B. Insulated Flexible Ducts, Medium Pressure: Located Upstream of Air Terminal Units.
   1. Manufacturers:
      a. Atco Rubber Products; OMNI Air 1200.
      b. Flexmaster: Type 4 (Basis of Design).
      c. Technaflex: 57K.
      d. Thermaflex: M-KC.
   2. UL 181, Class 1, heavy coated fiberglass cloth mechanically locked (no adhesives) to a helically wound galvanized steel wire, fiberglass insulation, black polyethylene vapor-barrier.
   3. Vapor Barrier Permeance: 0.1 perm ASTM E96, procedure A.
   4. Pressure rating: 12inch WG positive and 5-inch WG through 16-inch diameter.
   5. Temperature Range: Minus 20 to plus 210 deg F.
   6. Thermal Performance: R-value not less than 4.2 per ASTM C-518.

C. Insulated Flexible Duct located in vented attic, unvented attic above the envelope insulation or in a non-conditioned space.
   1. Flexible ducts same as specified above except with a Thermal Performance R-Value not less than 6.0 per ASTM C-518 shall be provided for:
      a. All flexible duct located in the attic.
      b. All flexible duct located in the space above the ceiling at the roof level.

D. Spin-Ins: Branch Duct Connectors for Connecting Round Low Pressure Duct to Rectangular Low-Pressure Duct:
   1. Manufactures:
      a. Flexmaster: FLD (Basis of Design)
   2. Galvanized steel G-90 minimum 26 gauge.

E. Side Takeoff Fitting: Rectangular Inlet with Round Outlet for Connecting Round Low Pressure Duct to Rectangular Low-Pressure Duct.
   1. Manufacturers:
      a. Flexmaster: STOD/B03. (Basis of Design)
   2. Galvanized steel, G-90 minimum 26 gauge.

F. Flexible Duct Clamps: Make Connections Between Flexible and Other Duct or Equipment with Duct Clamps:
   1. High and Medium Pressure (Upstream of Air Terminal Units): Stainless steel band with cadmium plated hex screw to tighten band with a worm gear action and duct sealer.
   2. Low Pressure: Nylon strap, above accessible ceilings. Provide stainless steel band with cadmium plated hex screw to tighten band with a worm gear action above inaccessible ceilings. Use stainless steel band above non-accessible ceilings.

G. Connect Air Terminal Units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

H. Connect diffusers to low-pressure ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

2.11 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install duct test holes where required for testing and balancing purposes.

3.2 DAMPERS

A. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

B. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
   1. Install steel volume dampers in steel ducts.
   2. Install aluminum volume dampers in aluminum ducts.

C. Set dampers to fully open position before testing, adjusting, and balancing. Saw mark end of shaft parallel with damper blade.

D. Connect ducts to sound attenuators rigidly.

3.3 DUCT ACCESS DOORS

A. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
   1. On both sides of duct coils.
   2. Downstream from control dampers.
   3. Upstream of air flow monitors (AFM).
   4. Elsewhere as indicated.

B. Access Door Sizes:
   1. One-Hand or Inspection Access: 8 by 5 inches.
   2. Two-Hand Access: 12 by 6 inches.
   3. Head and Hand Access: 18 by 10 inches.
   4. Head and Shoulders Access: 21 by 14 inches.

C. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

3.4 FLEXIBLE CONNECTORS

A. Install flexible connectors at all duct connections to all fans and AC units.

B. Install flexible connectors in all ducts at building expansion joints.

C. Electrical Grounding: Install braided copper jumpers around all flexible connections, taking care that jumpers do not bind flexes.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Operate dampers to verify full range of movement.

2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Inspect turning vanes for proper and secure installation.

END OF SECTION 23 0820

SECTION 23 0838

POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. In-line centrifugal fans.

1.2 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base air ratings on project site conditions.

B. Operating Limits: Classify according to AMCA 99.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material gages and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: For power ventilators to include in maintenance manuals specified in Division 01.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

C. UL Standard: Power ventilators shall comply with UL 705.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.6 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating." Label fans with the AMCA – Certified Rating Seal.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Basis of Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

2.2 IN-LINE CENTRIFUGAL FANS

A. Manufacturer:
   1. Barry Blower Div./Penn Ventilation Companies, Inc.
   2. Cook, Loren Company.
   3. Greenheck Fan Corp.

B. Description: In-line, direct driven centrifugal fans; as scheduled on the Drawings, consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

D. Direct-Driven Units: Motor encased in housing outside of airstream, factory wired to disconnect switch located on outside of fan housing.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

F. Accessories: Provide per fan equipment schedule on Drawings.
   1. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
   2. Companion Flanges: For inlet and outlet duct connections.
   3. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.

2.3 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

B. Enclosure Type: Guarded drip proof.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support suspended units from structure using threaded steel rods and spring hangers. Vibration-control devices are specified in Division 23 Section "Mechanical Vibration Controls and Seismic Restraints."

C. Install units with clearances for service and maintenance.

D. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Equipment Startup Checks:
   1. Verify that shipping, blocking, and bracing are removed.
   2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
   3. Verify that cleaning and adjusting are complete.
   4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
   5. Verify lubrication for bearings and other moving parts.
   6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
   7. Disable automatic temperature-control operators.

B. Starting Procedures:
   1. Energize motor and adjust fan to indicated rpm.
   2. Measure and record motor voltage and amperage.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Shut unit down and reconnect automatic temperature-control operators.

F. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.

G. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Lubricate bearings.

3.5 CLEANING

A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power ventilators.
   1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
   2. Review data in maintenance manuals. Refer to Division 01 Section "Closeout Procedures" or "Operations and Maintenance Data."
   3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 23 0838

SECTION 23 0840

AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Single-duct air terminal units.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Include a schedule showing unique model designation, model number, size, left or right-hand casing configuration for piping connections and controls access.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Ceiling suspension assembly members.
   2. Size and location of initial access modules for acoustical tile.
   3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Closeout Procedures or Operation and Maintenance Data," include the following:
   1. Instructions for calibrating air flow volumes.

1.3 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

1.4 COORDINATION

A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, HVAC and plumbing system piping, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHUTOFF SINGLE-DUCT AIR TERMINAL UNITS

A. Manufacturers:
1. Environmental Technologies, Inc.; Enviro-Air Div.
2. Price Industries.
3. Titus.
4. Trane.

B. Configuration: Volume-damper assembly inside unit casing with control components located inside a protective metal shroud.

C. Casing: 22-gauge galvanized steel.
1. Casing Lining: Adhesive attached, 3/8-inch- thick, closed cell foam insulation complying with UL 181 erosion requirements and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Access: Removable panels for access to hot water coil or electric heating element, adjustment, or maintenance; with airtight gasket.

D. Volume Damper: Galvanized steel with peripheral gasket, self-lubricating bearings, cast in damper position indicator and mechanical stop to prevent over stroking.
1. Maximum Damper Leakage: ARI 880 rated, 1 percent of nominal airflow at 4-inch wg inlet static pressure.
2. Damper Position: See Control Sequence on Drawings.

E. Attenuator Section: 22-gauge galvanized steel.
1. Lining: Same as box casing lining above.

F. Electric Heating Coil: Slip-in-type, open-coil design with integral control box factory wired and installed. Include the following features:
1. Automatic-reset primary and manual-reset secondary overtemperature protection.
2. Nickel chrome 80/20 heating elements.
3. Airflow switch (differential pressure).
4. Door interlock disconnect switch.
5. Fuses (for coils more than 48 A).
6. Magnetic contactor for each step of control.

G. DDC Controls: Single-package unitary controller and actuator specified in Division 23 Section "HVAC Instrumentation and Controls."
1. The air terminal units shall be equipped with pressure independent direct digital controls supplied by the control contractor and factory mounted by the terminal unit manufacturer. Control contractor shall provide data sheets on all components to be mounted, indicating component dimensions, mounting hardware, and methods, as well as wiring and piping diagrams for each application identified by unit tag per schedule in the drawings to the terminal manufacturer. Control Contractor shall be responsible for cost to ship controls to terminal unit manufacturer’s factory.
2. Controls shall be compatible with pneumatic inlet velocity sensors supplied by the terminal manufacturer. The sensor shall be multi-port center averaging type, with a minimum of four measuring ports, in series are not acceptable. The sensor must provide a minimum differential pressure signal of 0.03" wg. at an inlet velocity of 500 fpm.
3. Controls shall be field set by control contractor for the scheduled minimum and maximum flow rates. Flow measuring taps and flow curves will be supplied with each terminal for field

balancing airflow. All pneumatic tubing shall be UL listed fire retardant (FR) type. Each terminal shall be equipped with labeling showing unit location, size, and scheduled cfm.

4. Terminal manufacturer to provide a Class 2, 24-volt control transformer and disconnect switch.
5. All controls shall be installed in approved NEMA type sheet metal enclosure provided by terminal manufacturer.
6. Control enclosure and wiring shall meet UL listing and labeling requirements of the Local Building Official.
7. If controls are field mounted, air terminal manufacturer shall provide a UL labeled control enclosure and additionally provide disconnect switch and control transformer for air terminals with a fan or electric heat.

2.3 SOURCE QUALITY CONTROL

A. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

B. Verification of Performance: Rate air terminal units according to ARI 880.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

3.2 CONNECTIONS

A. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."

B. Ground units with electric heating coils according to Division 26.

C. Connect wiring according to Division 26 Section.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Complete installation and startup checks according to manufacturer's written instructions and do the following:
1. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
2. Verify that controls and control enclosure are accessible.
3. Verify that control connections are complete.
4. Verify that nameplate and identification tag are visible.
5. Verify that controls respond to inputs as specified.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units. Refer to Division 01 Section "Closeout Procedures or Demonstration and Training."

END OF SECTION 23 0840

SECTION 23 0855

AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Diffusers.

B. Registers / Grilles.

C. Weather Louvers.

1.2 SUBMITTALS

A. Submit under provisions of Section 230010.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.3 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 062 and ASHRAE 70.

B. Test and rate louver performance in accordance with AMCA 500.

PART 2 - PRODUCTS

2.1 GRILLES, REGISTERS AND DIFFUSERS - GENERAL

A. Acceptable Manufacturer's:
1. Titus.
2. Metal Air.
3. Kreuger.
4. Carnes.
5. Price.
6. Tuttle & Bailey.

B. Coordinate / verify border and frame types for ceiling air devices are shown on Architectural Reflective Ceiling Plan.

C. Equip all ceiling mounted air devices with ceiling radiation dampers and thermal blankets.

2.2 SQUARE PLAQUE CEILING DIFFUSERS (ACD)

A. Manufacturer's:
1. Titus Model OMNI: Steel construction.

B. Type: Square plaque stamped diffuser to discharge air in 360 pattern as scheduled with round neck.

C. Neck sizes as shown on drawings, held in place by four hooks; foil backed insulation.

D. Fabrication: Steel with baked white anodic acrylic paint finish.

E. Accessories: Manual damper.

2.3 LINEAR SLOT DIFFUSER (LSD)

A. Manufacturer:
1. Titus, Model TBDI-80.

B. Type: Continuous, 1-inch-wide slot, number of slots wide as scheduled, with adjustable vanes for left, right or vertical discharge; integral ceiling fire damper.

C. Fabrication: Steel with factory baked enamel finish. Exposed surfaces black. T-bar white.

D. Plenum: Integral, galvanized steel, insulated.

E. Accessories: T-bar one side with mounting clip-on opposite side.

2.4 WALL SUPPLY REGISTERS (SR)

A. Manufacturers:
1. Titus Model 300F.

B. Type: Individually adjustable blades, 3/4-inch minimum depth, 3/4-inch maximum spacing with friction pivots to set blades, vertical face, double deflection.

C. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

D. Fabrication: Aluminum with factory white baked anodic acrylic paint finish.

E. Damper: Integral, gang-operated opposed blade type operable from face.

2.5 CEILING EGGCRATE EXHAUST, RETURN AND TRANSFER REGISTERS/GRILLES (E,R,T)

A. Manufacturers:
1. Titus Model 50F.

B. Type: Fixed grilles of 1/2 x 1/2-inch eggcrate.

C. Border:
1. Neck sizes up to 12x12 inch, 1-1/4 inch margin with countersunk screw mounting, with plaster frame.
2. Neck size 14x14 inch and larger, lay in frame.

D. Fabrication: All aluminum with factory white anodic acrylic finish. Provide steel border when scheduled to be equipped with ceiling radiation damper.

E. Damper: Integral, gang-operated, opposed blade type operable from face. Omit damper on transfer grilles (T) and non-ducted return grilles.

2.6 WEATHER LOUVERS

A. Weather Louvers specified under Division 08.

B. Manufacturers:
1. Greenheck Model ESD-603.
2. Other acceptable manufacturers offering equivalent products.
   a. Ruskin.
   b. Airolite.
   c. Construction Specialties.

C. Type: 6 inch deep with stationary blades on 45-degree slope with integral gutter on each jamb shall incorporate an integral downspout, heavy channel frame.

D. Fabrication: 12-gauge thick extruded aluminum, welded assembly, with factory 3 coat Kynar 500 fluoropolymer spray finish, factory standard color to be selected.

E. Mounting: Furnish with exterior masonry strap anchors for installation.

F. Accessories: Removable, rear mounted, 1/2" mesh aluminum birdscreen; extended sill finished to match louver.

G. Performance: 4'x4' unit: Free area = 8.53 sq.ft. (53%); at an intake 1,250 FPM free area velocity static pressure drop not exceeding 0.26" water gauge and water penetration not exceeding 0.01 ounces of water per sq.ft.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlet and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangements.

C. Install diffusers to ductwork with airtight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 099100.

F. Ceiling mounted air devices connected with flexible duct shall be secured to prevent falling if grid shifts.

G. Weather Louvers: Blank unused portion of louvers with sandwich of 1 inch duct liner with 26-gauge galvanized steel inner and outer panels. Fasten blanks to indoor side of louvers with sheet metal screws and seal with duct sealer.

END OF SECTION 23 0855

SECTION 23 0900

HVAC INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

1.2 DEFINITIONS

A. DDC: Direct digital control.

B. I/O: Input/output.

C. MS/TP: Master slave/token passing.

D. PC: Personal computer.

E. PID: Proportional plus integral plus derivative.

F. RTD: Resistance temperature detector.

1.3 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:
   1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
   2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
   3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
   4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
   5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
   6. Program Execution Frequency: Run capability of applications as often as five seconds but selected consistent with mechanical process under control.
   7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
   8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
      a. Water Temperature: Plus or minus 1 deg F.
      b. Water Flow: Plus or minus 5 percent of full scale.
      c. Water Pressure: Plus or minus 2 percent of full scale.
      d. Space Temperature: Plus or minus 1 deg F.
      e. Ducted Air Temperature: Plus or minus 1 deg F.
      f. Outside Air Temperature: Plus or minus 2 deg F.
      g. Dew Point Temperature: Plus or minus 3 deg F.
      h. Temperature Differential: Plus or minus 0.25 deg F.
      i. Relative Humidity: Plus or minus 5 percent.
      j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
      k. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
      l. Airflow (Terminal): Plus or minus 10 percent of full scale.

m. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
n. Carbon Monoxide: Plus or minus 5 percent of reading.
o. Carbon Dioxide: Plus or minus 50 ppm.
p. Electrical: Plus or minus 5 percent of reading.

1.4 SEQUENCE OF OPERATION

A. Control diagrams on drawings are intended to indicate, in general, control arrangements. Provide all instruments, relays, operators, switches, etc. required to accomplish control sequences whether or not such devices are actually shown on control diagrams.

1.5 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
3. Wiring Diagrams: Power, signal, and control wiring.
4. Details of control panel faces, including controls, instruments, and labeling.
5. Written description of sequence of operation.
6. Schedule of dampers including size, leakage, and flow characteristics.
7. Schedule of valves including flow characteristics.
8. DDC System Hardware:
a. Wiring diagrams for control units with termination numbers.
b. Schematic diagrams and drawings for field sensors and control hardware.
c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
10. Controlled Systems:
a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
c. Written description of sequence of operation including schematic diagram.
d. Points list.

C. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.

D. Samples for Initial Selection: For each color required, of each type of thermostat or sensor cover with factory-applied color finishes.

E. Samples for Verification: For each color required, of each type of thermostat or sensor cover.

F. Software and Firmware Operational Documentation: Include the following:
1. Software operating and upgrade manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.
5. Software license required by and installed for DDC workstations and control systems.

G. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.

H. Qualification Data: For installer.

I. Field quality-control test reports.

J. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
5. Calibration records and list of set points.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with ASHRAE 135 for DDC system components.

1.7 DELIVERY, STORAGE, AND HANDLING

A. System Software: Update to latest version of software at Project completion.

1.8 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with drawings and room details before installation.

B. Coordinate equipment with Division 28 Section "Intrusion Detection" to achieve compatibility with equipment that interfaces with that system and with building master clock.

C. Coordinate equipment with Division 28 Section "Security Access" to achieve compatibility with equipment that interfaces with that system.

D. Coordinate equipment with Division 28 Section "Clock and Program Control" to achieve compatibility with equipment that interfaces with that system.

E. Coordinate equipment with Division 28 Section "Detention Monitoring and Control (PLC Based)" to achieve compatibility with equipment that interfaces with that system.

F. Coordinate equipment with Division 28 Section "Lighting Controls" to achieve compatibility with equipment that interfaces with that system.

G. Coordinate equipment with Division 28 Section "Fire Alarm" to achieve compatibility with equipment that interfaces with that system.

H. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.

I. Coordinate equipment with Division 26 Section "Electrical Power Monitoring and Control" to achieve compatibility of communication interfaces.

J. Coordinate equipment with Division 26 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.

K. Coordinate equipment with Division 26 Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

L. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Replacement Materials: One replacement diaphragm or relay mechanism for each unique positioning relay.
   2. Maintenance Materials: One thermostat adjusting key(s).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to, manufacturers specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CONTROL SYSTEM

A. Available Manufacturers:
   1. Trane; Worldwide Applied Systems Group
   2. Automated Logic Corporation.
   3. Honeywell International Inc.; Home & Building Control.
   4. Johnson Controls, Inc.; Controls Group.
   5. KMC Controls/Kreuter Manufacturing Company.
   6. Siemens Building Technologies, Inc.
   7. STC Worldwide.

B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

C. Control system shall include the following:
1. Building intrusion detection system specified in Division 28 Section "Intrusion Detection."
2. Building clock control system specified in Division 28 Section "Clock and Program Control."
3. Building lighting control system specified in Division 28 Section "Lighting Controls."
4. Fire alarm system specified in Division 28 Section "Fire Alarm."

2.3 DDC EQUIPMENT

A. Operator Workstation: One PC-based microcomputer(s) with minimum configuration as follows:
1. Motherboard: With 8 integrated USB 2.0 ports, integrated Intel Pro 10/100 (Ethernet), integrated audio, bios, and hardware monitoring.
2. Processor: Intel Pentium 11
3. Random-Access Memory: 64 GB.
4. Graphics: Video adapter, minimum 1600 x 1200 pixels, 64 MB video memory, with TV out.
5. Monitor: 24 inches, LCD color.
6. Keyboard: QWERTY, 105 keys in ergonomic shape.
7. Hard-Disk Drive: 500 GB .
8. Mouse: Three button, optical.
9. Uninterruptible Power Supply: 350 kVa.
10. Operating System: Microsoft Windows 10 with high-speed Internet access.
    a. ASHRAE 135 Compliance: Workstation shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
11. Printer: Color, ink-jet type as follows:
    a. Print Head: 4800 x 1200 dpi optimized color resolution.
    b. Paper Handling: Minimum of 100sheets.
    c. Print Speed: Minimum of 17ppm in black and 12ppm in color.
12. Application Software:
    a. I/O capability from operator station.
    b. System security for each operator via software password and access levels.
    c. Automatic system diagnostics; monitor system and report failures.
    d. Database creation and support.
    e. Automatic and manual database save and restore.
    f. Dynamic color graphic displays with up to 10 screen displays at once.
    g. Custom graphics generation and graphics library of HVAC equipment and symbols.
    h. Alarm processing, messages, and reactions.
    i. Trend logs retrievable in spreadsheets and database programs.
    j. Alarm and event processing.
    k. Object and property status and control.
    l. Automatic restart of field equipment on restoration of power.
    m. Data collection, reports, and logs. Include standard reports for the following:
        1) Current values of all objects.
        2) Current alarm summary.
        3) Disabled objects.
        4) Alarm lockout objects.
        5) Logs.
    n. Custom report development.
    o. Utility and weather reports.
    p. ASHRAE Guideline 3 report.
    q. Workstation application editors for controllers and schedules.
    r. Maintenance management.

13. Custom Application Software:
    a. English language oriented.
    b. Full-screen character editor/programming environment.
    c. Allow development of independently executing program modules with debugging/simulation capability.
    d. Support conditional statements.
    e. Support floating-point arithmetic with mathematical functions.
    f. Contains predefined time variables.

B. Diagnostic Terminal Unit: Portable notebook-style, PC-based microcomputer terminal capable of accessing system data by connecting to system network with minimum configuration as follows:
1. System: With one integrated USB 2.0 port, integrated Intel Pro 10/100 (Ethernet), integrated audio, bios, and hardware monitoring.
2. Processor: Intel Pentium 11
3. Random-Access Memory: 64GB.
4. Graphics: Video adapter, minimum 1024 x 768 pixels, 64 MB video memory.
5. Monitor: 17 inches, LCD color.
6. Keyboard: QWERTY 105 keys in ergonomic shape.
7. Hard-Disk Drive: 500 GB.
8. Pointing Device: Touch pad or other internal device.

C. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
    a. Global communications.
    b. Discrete/digital, analog, and pulse I/O.
    c. Monitoring, controlling, or addressing data points.
    d. Software applications, scheduling, and alarm processing.
    e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
3. Standard Application Programs:
    a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, anti-short cycling, PID control, DDC with fine tuning, and trend logging.
    b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
    c. Chiller Control Programs: Control function of condenser-water reset, chilled-water reset, and equipment sequencing.
    d. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
    e. Remote communications.
    f. Maintenance management.
    g. Units of Measure: Inch-pound and SI (metric).
4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.

5. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

D. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
   a. Global communications.
   b. Discrete/digital, analog, and pulse I/O.
   c. Monitoring, controlling, or addressing data points.
3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

E. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
7. Universal I/Os: Provide software selectable binary or analog outputs.

F. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

G. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
1. Minimum dielectric strength of 1000 V.
2. Maximum response time of 10 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.4 UNITARY CONTROLLERS

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.

1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.
3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.
4. Indoor enclosure: Dustproof rated for operation at 32 to 120 deg F.
5. Outdoor enclosure: Waterproof rated for operation at 40 to 150 deg F.

2.5 ALARM PANELS

A. Unitized cabinet with suitable brackets for wall or floor mounting. Fabricate of 0.06-inch- thick furniture-quality steel or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish. Provide common keying for all panels.

B. Indicating light for each alarm point, single horn, acknowledge switch, and test switch, mounted on hinged cover.
1. Alarm Condition: Indicating light flashes and horn sounds.
2. Acknowledge Switch: Horn is silent and indicating light is steady.
3. Second Alarm: Horn sounds and indicating light is steady.
4. Alarm Condition Cleared: System is reset and indicating light is extinguished.
5. Contacts in alarm panel allow remote monitoring by independent alarm company.

2.6 ANALOG CONTROLLERS

A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.

B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F, and single- or double-pole contacts.

C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.

D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

E. Receiver Controllers: Single- or multiple-input models with control-point adjustment, direct or reverse acting with mechanical set-point adjustment with locking device, proportional band adjustment, authority adjustment, and proportional control mode.
1. Remote-control-point adjustment shall be plus or minus 20 percent of sensor span, input signal of 3 to 13 psig.
2. Proportional band shall extend from 2 to 20 percent for 5 psig.
3. Authority shall be 20 to 200 percent.

4. Air-supply pressure of 18 psig, input signal of 3 to 15 psig, and output signal of zero to supply pressure.
5. Gages: 3-1/2 inches in diameter, 2.5 percent wide-scale accuracy, and range to match transmitter input or output pressure.

2.7 TIME CLOCKS

A. Available Manufacturers:
1. ATC-Diversified Electronics.
2. Grasslin Controls Corporation.
3. Paragon Electric Co., Inc.
4. Precision Multiple Controls, Inc.
5. SSAC Inc.; ABB USA.
6. TCS/Basys Controls.
7. Theben AG - Lumilite Control Technology, Inc.
8. Time Mark Corporation.

B. Solid-state, programmable time control with 4 separate programs each with up to 100 on-off operations; 1-second resolution; lithium battery backup; keyboard interface and manual override; individual on-off-auto switches for each program; 365-day calendar with 20 programmable holidays; choice of fail-safe operation for each program; system fault alarm; and communications package allowing networking of time controls and programming from PC.

2.8 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Thermistor Temperature Sensors and Transmitters:
1. Available Manufacturers:
   a. BEC Controls Corporation.
   b. Ebtron, Inc.
   c. Heat-Timer Corporation.
   d. I.T.M. Instruments Inc.
   e. MAMAC Systems, Inc.
   f. RDF Corporation.
2. Accuracy: Plus or minus 0.5 deg F at calibration point.
3. Wire: Twisted, shielded-pair cable.
4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
5. Averaging Elements in Ducts: 36 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft.
6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

C. RTDs and Transmitters:
1. Accuracy: Plus or minus 0.2 percent at calibration point.
2. Wire: Twisted, shielded-pair cable.
3. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.

4. Averaging Elements in Ducts: 18 inches long, rigid; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
5. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
6. Room Sensor Cover Construction: Manufacturer's standard locking covers.
7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
8. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

D. Humidity Sensors: Bulk polymer sensor element.
1. Accuracy: 2 percent full range with linear output.
2. Room Sensor Range: 20 to 80 percent relative humidity.
3. Room Sensor Cover Construction: Manufacturer's standard locking covers.
4. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
5. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of minus 22 to plus 185 deg F.
6. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

E. Pressure Transmitters/Transducers:
1. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
b. Output: 4 to 20 mA.
c. Building Static-Pressure Range: 0- to 0.25-inch wg.
d. Duct Static-Pressure Range: 0- to 5-inch wg.
2. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
3. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.
4. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
5. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.

F. Room Sensor Cover Construction: Manufacturer's standard locking covers.

G. Room sensor accessories include the following:
1. Insulating Bases: For sensors located on exterior walls.
2. Guards: Locking; heavy-duty, transparent plastic; mounted on separate base
3. Adjusting Key: As required for calibration and cover screws.

2.9 STATUS SENSORS

A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.

B. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

C. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.

D. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage, and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.

E. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.

F. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

2.10 GAS DETECTION EQUIPMENT

A. Available Manufacturers:
1. B. W. Technologies.
2. CEA Instruments, Inc.
3. Ebtron, Inc.
4. Gems Sensors Inc.
5. Greystone Energy Systems Inc.
6. Honeywell International Inc.; Home & Building Control.
7. INTEC Controls, Inc.
8. I.T.M. Instruments Inc.

B. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment; for flush mounting.

2.11 FLOW MEASURING STATIONS

A. Duct Airflow Station: Combination of air straightener and multiport, self-averaging pitot tube station.
1. Available Manufacturers:
   a. Air Monitor Corporation.
   b. Ebtron.
2. Casing: Galvanized steel frame.
3. Flow Straightener: Aluminum honeycomb, 3/4-inch parallel cell, 3 inches deep.
4. Sensing Manifold: Copper manifold with bullet-nosed static pressure sensors positioned on equal area basis.

2.12 THERMOSTATS

A. Combination Thermostat and Fan Switches: Line-voltage thermostat with push-button or lever-operated fan switch.
1. Label switches “FAN ON-OFF".
2. Mount on single electric switch box.

B. Electric, solid-state, microcomputer-based room thermostat with remote sensor.
1. Automatic switching from heating to cooling.
2. Preferential rate control to minimize overshoot and deviation from set point.
3. Set up for four separate temperatures per day.
4. Instant override of set point for continuous or timed period from 1 hour to 31 days.
5. Short-cycle protection.
6. Programming based on weekday, Saturday, and Sunday.
7. Selection features include degree F or degree C display, 12- or 24-hour clock, keyboard disable, remote sensor, and fan on-auto.
8. Battery replacement without program loss.
9. Thermostat display features include the following:
   a. Time of day.
   b. Actual room temperature.
   c. Programmed temperature.

d. Programmed time.
e. Duration of timed override.
f. Day of week.
g. System mode indications include "heating," "off," "fan auto," and "fan on."

C. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.

D. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.
1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
2. Selector Switch: Integral, manual on-off-auto.

E. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.
1. Bulbs in water lines with separate wells of same material as bulb.
2. Bulbs in air ducts with flanges and shields.
3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.
4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.
6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.

F. Fire-Protection Thermostats: Listed and labeled by an NRTL acceptable to authorities having jurisdiction; with fixed or adjustable settings to operate at not less than 75 deg F above normal maximum operating temperature, and the following:
1. Reset: Manual.

G. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.

H. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.

I. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.
1. Bulb Length: Minimum 20 feet.
2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

J. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above set point.
1. Bulb Length: Minimum 20 feet.
2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

K. Heating/Cooling Valve-Top Thermostats: Proportional acting for proportional flow, with molded-rubber diaphragm, remote-bulb liquid-filled element, direct and reverse acting at minimum shutoff pressure of 25 psig and cast housing with position indicator and adjusting knob.

2.13 HUMIDISTATS

A. Duct-Mounting Humidistats: Electric insertion, 2-position type with adjustable, 2 percent throttling range, 20 to 80 percent operating range, and single- or double-pole contacts.

2.14 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
   1. Comply with requirements in Division 23 Section "Motors."
   2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
   3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
   4. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
   5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
   6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
   1. Valves: Size for torque required for valve close off at maximum pump differential pressure.
   2. Dampers: Size for running torque calculated as follows:
      a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
      b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
      c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft of damper.
      d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
      e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
      f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
   3. Coupling: V-bolt and V-shaped, toothed cradle.
   4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
   5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
   6. Power Requirements (Two-Position Spring Return): 24-V ac.
   7. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
   8. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
   9. Temperature Rating: Minus 22 to plus 122 deg F.
   10. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
   11. Run Time: 12 seconds open, 5 seconds closed.

2.15 DAMPERS

A. Dampers: AMCA-rated, opposed-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades

shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.

1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

2.16 CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring are specified in Division 26 Section "Voice and Data Communication Cabling."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that power supply is available to control units and operator workstation.

3.2 INSTALLATION

A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above the floor.
   1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

D. Install guards on thermostats in the following locations:
   1. Entrances.
   2. Public areas.
   3. Where indicated.

E. Install automatic dampers according to Division 23 Section "Duct Accessories."

F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

G. Install labels and nameplates to identify control components according to Division 23 Section "Mechanical Identification."

H. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."

I. Install refrigerant instrument wells, valves, and other accessories according to Division 23 Section "Refrigerant Piping."

J. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.

K. Install electronic and fiber-optic cables according to Division 26 Section "Voice and Data Communication Cabling."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
   2. Test and adjust controls and safeties.
   3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
   4. Test each point through its full operating range to verify that safety and operating control set points are as required.
   5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
   6. Test each system for compliance with sequence of operation.
   7. Test software and hardware interlocks.

C. DDC Verification:
   1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
   2. Check instruments for proper location and accessibility.
   3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
   4. Check instrument tubing for proper fittings, slope, material, and support.
   5. Check installation of air supply for each instrument.
   6. Check flow instruments. Inspect tag number and line and bore size and verify that inlet side is identified and that meters are installed correctly.
   7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
   8. Check temperature instruments and material and length of sensing elements.
   9. Check control valves. Verify that they are in correct direction.
   10. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
   11. Check DDC system as follows:
      a. Verify that DDC controller power supply is from emergency power supply, if applicable.
      b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
      c. Verify that spare I/O capacity has been provided.
      d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.4 ADJUSTING

A. Calibrating and Adjusting:
   1. Calibrate instruments.
   2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
   3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
   4. Control System Inputs and Outputs:
      a. Check analog inputs at 0, 50, and 100 percent of span.

b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
c. Check digital inputs using jumper wire.
d. Check digital outputs using ohmmeter to test for contact making or breaking.
e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.

5. Flow:
   a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
   b. Manually operate flow switches to verify that they make or break contact.
6. Pressure:
   a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
   b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
7. Temperature:
   a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
   b. Calibrate temperature switches to make or break contacts.
8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 23 0900

SECTION 23 0950

TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1. SUMMARY

A. This Section includes TAB to produce design objectives for the following:
   1. Air Systems.
   2. Duct leakage tests.
   3. Hydronic Piping Systems.
   4. HVAC equipment quantitative-performance settings.
   5. Duct mounted smoke detectors.
   6. Verifying that automatic control devices are functioning properly.
   7. Reporting results of activities and procedures specified in this Section.

1.2. DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.

D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

E. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

F. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

G. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

H. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

I. TAB: Testing, adjusting, and balancing.

J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

1.3. SUBMITTALS

A. Qualification Data: Submit evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article and below.

B. Sample Report Forms: Submit sample TAB report forms.

C. Certified TAB Reports: Submit three copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

1.4. QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.

B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
   1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
   2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use TAB firm's forms approved by Architect.

D. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

E. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
   1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.5. PROJECT CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.6. COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

D. Coordinate all TAB work through the contract schedule. Certified TAB reports are required one month prior to Substantial Completion to allow thorough review. The Certified TAB report must be approved by the Owner, Engineer and Commissioning Firm (if applicable) before the project can receive Substantial Completion.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine approved submittal data of HVAC systems and equipment.

B. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

C. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

D. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

E. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.

F. Examine plenum ceilings used for return air to verify that they are airtight with no openings to the exterior.

G. Examine strainers for clean screens and proper perforations.

H. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

I. Examine equipment for installation and for properly operating safety interlocks and controls.

J. Examine automatic temperature system components to verify the following:
   1. Dampers, valves, and other controlled devices are operated by the intended controller.
   2. Dampers and valves are in the position indicated by the controller.
   3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multi-zone units, mixing boxes, and variable-air-volume terminals.
   4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
   5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
   6. Sensors are located to sense only the intended conditions.
   7. Sequence of operation for control modes is according to the Contract Documents.
   8. Controller set points are set at indicated values.
   9. Interlocked systems are operating.
   10. Changeover from heating to cooling mode occurs according to indicated values.

K. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.3 PROCEDURES FOR DUCTWORK LEAKAGE TESTING

A. Scope and Leakage Rate: Refer to Division 23 Section “Metal Ducts, Part 3, Article “Field Quality Control” for extent of ductwork to be tested and allowable leakage rates.

B. Prior to testing, submit drawings indicating sections of ductwork to be tested, including duct surface area and allowable leakage (CFM) calculations.

C. Leakage testing shall be performed in accordance with ASHRAE/SMACNA Standard 126 “Method of Testing HVAC Air Ducts and Fittings” except as noted otherwise on drawings or specifications.

D. Submit a report certifying ductwork testing and results.

E. Ductwork failing test shall be reconstructed and retested until satisfactory.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Verify that motor starters are equipped with properly sized thermal protection.

E. Check dampers for proper position to achieve desired airflow path.

F. Check for airflow blockages.

G. Check for proper sealing of air-handling unit components.

H. Check for proper sealing of air duct system.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure fan static pressures to determine actual static pressure as follows:
      a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
      b. Measure static pressure directly at the fan outlet or through the flexible connection.
      c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
      d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
   2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
      a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
   3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, under final balanced conditions.
   4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Recommend corrective action to align design and actual conditions.
   5. Make required adjustments to pulley sizes to accommodate fan-speed changes.
   6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
   1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
      a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Re-measure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure terminal outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set outside-air dampers at minimum and return- and exhaust-air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
    a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
6. Re-measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
7. Measure static pressure at the most critical terminal unit and coordinate with control contractor to adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record the final fan performance data.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
   1. Open all manual valves for maximum flow.
   2. Check makeup-water-station pressure gage for adequate pressure (min. 5 psig) for highest vent.
   3. Check flow-control valves for specified sequence of operation and set at indicated flow.
   4. Set system controls so automatic valves are wide open to heat exchangers.
   5. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.

3.8 PROCEDURES FOR HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures:
   1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
   2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
   3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
   4. Report flow rates that are not within plus or minus 5 percent of design.

B. Set calibrated balancing valves, if installed, at calculated presettings.

C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
   1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
   1. Determine the balancing station with the highest percentage over indicated flow.
   2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
   3. Record settings and mark balancing devices.

F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

B. Compensating for Diversity: When the total water flow of all terminal units is more than the indicated water flow of the pump, place a selected number of terminal units at a minimum set-point water flow condition until the total water flow of the terminal units equals the indicated water flow of the pump. Select the reduced water flow terminal units so they are distributed evenly among the branch pipes.

C. Measure differential static pressure at the most critical terminal unit or air handler and coordinate with controls contractor to adjust the differential pressure controller, at the main differential sensor/transmitter, to ensure that adequate differential pressure is maintained at the most critical unit.

D. Record the final pump performance data.

3.10 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.11 PROCEDURES FOR CHILLERS

A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:
1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
2. If water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.

3.12 PROCEDURES FOR HEAT-TRANSFER COILS

A. Water Coils: Measure the following data for each coil:
1. Water flow rate.
2. Water pressure drop.
3. Airflow.
4. Air pressure drop.

B. Electric-Heating Coils: Measure the following data for each coil:
1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.

C. Refrigerant Coils: Measure the following data for each coil:
1. Airflow.
2. Air pressure drop.

3.13 PROCEDURES FOR DUCT MOUNTED SMOKE DETECTORS TESTING

A. All duct smoke detectors shall be tested to ensure that the devices properly sample the air stream.

B. The tests shall be made in accordance with the smoke detector manufacturer’s requirements and instructions.

C. Provide testing documentation so that it can be included with the Closeout Documents for the fire alarm system.

3.14 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

G. Check the interaction of electrically operated switch transducers.

H. Check the interaction of interlock and lockout systems.

I. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or non-grounded power supply.

J. Note operation of electric actuators using spring return for proper fail-safe operations.

3.15 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 10 to minus 10 percent.
2. Air Outlets and Inlets: Plus 10 to minus 10 percent.
3. Cooling-Water Flow Rate: Plus 10 to minus 10 percent.

3.16 REPORTING

A. Status Reports: As Work progresses, prepare reports to describe deficiencies and problems found in systems being tested and balanced.

3.17 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, bound, tabulated, and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed by the certified testing and balancing Agent.
1. Include a list of instruments used for procedures, along with proof of calibration.

C. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
1. Title page.
2. Name and address of TAB firm.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB firm who certifies the report.
10. Table of Contents.

11. Summary of contents including the following:
    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer, type, and size.
14. Notes to explain why certain final data in the body of reports varies from indicated values.
15. Test conditions for fans and pump performance forms including the following:
    a. Settings for outside-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Face and bypass damper settings at coils.
    d. Fan drive settings including settings and percentage of maximum pitch diameter.
    e. Settings for supply-air, static-pressure controller.
    f. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outside, supply, return, and exhaust airflows.
2. Terminal units.
3. Balancing stations.

E. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data: Include the following:
    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Sheave make, size in inches, and bore.
    g. Sheave dimensions, center-to-center, and amount of adjustments in inches.
    h. Number of belts, make, and size.
    i. Number of filters, type, and size.
2. Motor Data:
    a. Make and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
3. Test Data (Indicated and Actual Values):
    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Filter static-pressure differential in inches wg.
    f. Preheat coil static-pressure differential in inches wg.
    g. Cooling coil static-pressure differential in inches wg.
    h. Heating coil static-pressure differential in inches wg.
    i. Outside airflow in cfm.
    j. Return airflow in cfm.

F. Apparatus-Coil Test Reports:
   1. Coil Data:
      a. System identification.
      b. Location.
      c. Coil type.
   2. Test Data (Indicated and Actual Values):
      a. Airflow rate in cfm.
      b. Air pressure drop in inches wg.
      c. Return-air, wet- and dry-bulb temperatures in deg F.
      d. Entering-air, wet- and dry-bulb temperatures in deg F.
      e. Leaving-air, wet- and dry-bulb temperatures in deg F.
      f. Water flow rate in gpm.
      g. Water pressure differential in feet of head or psig.
      h. Entering-water temperature in deg F.
      i. Leaving-water temperature in deg F.

G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
   1. Unit Data:
      a. System identification.
      b. Location.
      c. Coil identification.
   2. Test Data (Indicated and Actual Values):
      a. Airflow rate in cfm.
      b. Entering-air temperature in deg F.
      c. Leaving-air temperature in deg F.
      d. Voltage at each connection.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
   1. Fan Data:
      a. System identification.
      b. Location.
   2. Motor Data:
      a. Make and frame type and size.
      b. Horsepower and rpm.
      c. Volts, phase, and hertz.
      d. Full-load amperage and service factor.
      e. Sheave make, size in inches, and bore.
      f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
      g. Number of belts, make, and size.
   3. Test Data (Indicated and Actual Values):
      a. Total airflow rate in cfm.
      b. Total system static pressure in inches wg.
      c. Fan rpm.
      d. Discharge static pressure in inches wg.
      e. Suction static pressure in inches wg.

I. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
   1. Report Data:
      a. System and air-handling unit number.

b. Location and zone.
c. Duct static pressure in inches wg.
d. Duct size in inches.
e. Duct area in sq. ft.
f. Indicated airflow rate in cfm.
g. Indicated velocity in fpm.
h. Actual airflow rate in cfm.
i. Actual average velocity in fpm.

J. Air-Terminal-Device Reports:
1. Unit Data:
a. System and air-handling unit identification.
b. Location.
c. Air-terminal-device number from system diagram.
d. Air-terminal-device type and model number.
e. Air-terminal-device size.
f. Air-terminal-device effective area in sq. ft.
2. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm.
b. Preliminary airflow rate as needed in cfm.
c. Final airflow rate in cfm.

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data:
a. System and air-handling unit identification.
b. Location and zone.
c. Room or riser served.
d. Flowmeter type.
2. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

L. Packaged Chiller Reports:
1. Unit Data:
a. Unit identification.
b. Make and model number.
2. Water-Cooled Condenser Test Data (Indicated and Actual Values):
a. Entering water temperature in deg F.
b. Leaving water temperature in deg F.
c. Entering water pressure in feet of head or psig.
d. Water pressure differential in feet of head or psig.
3. Evaporator Test Reports (Indicated and Actual Values):
a. Entering water temperature in deg F.
b. Leaving water temperature in deg F.
c. Entering water pressure in feet of head or psig.
d. Water pressure differential in feet of head or psig.

M. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
   1. Unit Data:
      a. Unit identification.
      b. Location.
      c. Service.
      d. Make and size.
      e. Model and serial numbers.
      f. Water flow rate in gpm.
      g. Water pressure differential in feet of head or psig.
      h. Required net positive suction head in feet of head or psig.
      i. Pump rpm.
      j. Impeller diameter in inches.
      k. Motor make and frame size.
      l. Motor horsepower and rpm.
      m. Voltage at each connection.
      n. Amperage for each phase.
      o. Full-load amperage and service factor.
      p. Seal type.
   2. Test Data (Indicated and Actual Values):
      a. Static head in feet of head or psig.
      b. Pump shutoff pressure in feet of head or psig.
      c. Actual impeller size in inches.
      d. Full-open flow rate in gpm.
      e. Full-open pressure in feet of head or psig.
      f. Final discharge pressure in feet of head or psig.
      g. Final suction pressure in feet of head or psig.
      h. Final total pressure in feet of head or psig.
      i. Final water flow rate in gpm.
      j. Voltage at each connection.
      k. Amperage for each phase.

N. Instrument Calibration Reports:
   1. Report Data:
      a. Instrument type and make.
      b. Serial number.
      c. Application.
      d. Dates of calibration.

3.18 INSPECTIONS

A. Before final acceptance of the Tab Report:
   1. Owner or Architect shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
   2. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
   3. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

4. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
5. Request a second final inspection.

END OF SECTION 23 0950

SECTION 23 2113

HYDRONIC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and pipe fittings for:
   1. Chilled water piping.
   2. Equipment drains and overflows piping.
   3. Pre-insulated and factory cladded piping.
   4. Welded branch and tap connections.
   5. Pipe hangers and supports.
   6. Joining materials.
   7. Unions, flanges, and couplings.
   8. Dielectric fittings.
   9. Transition fittings.

B. Valves:
   1. Gate valves.
   2. Globe or angle valves.
   3. Ball valves.
   4. Below grade ball valves.
   5. Plug valves.
   6. Butterfly valves.
   7. Check valves.

C. Water treatment for closed loop systems:
   1. HVAC water treatment equipment.
   2. HVAC Water filtration equipment.
   3. HVAC water treatment chemicals.

1.2 RELATED SECTIONS

A. Section 230062 “Hangers and Supports for HVAC Piping and Equipment” for pipe and equipment supports.

B. Section 230900 “HVAC Instrumentation and Controls” for Automatic Temperature-Control Valves and Actuators.

C. Section 312000 “Earth Moving” for excavating, trenching, and backfilling.

1.3 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified for an application, Contractor may use any of the listed pipe materials for that application.

B. Where more than one piping system material is applied, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

C. Use unions, flanges, and couplings at control valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to control valves, equipment, or other apparatus.

D. Use non-conducting dielectric connections whenever joining dissimilar metals.

E. Provide pipe hangers and supports in accordance with ASTM B31.9 unless indicated otherwise.

F. Use spring loaded check valves on discharge of pumps.

G. Use lug end butterfly valves to isolate equipment for pipe size NPS 2-1/2 and larger.

H. Use NPS ¾ ball valves with hose end connection and cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

1.4 ACTION SUBMITTALS

A. Product Data for each of the following
   1. Pipe material, pipe fittings, valves, and accessories.
   2. Chemical treatment for closed loop systems.

B. Welders certificates.

C. Anchors for Underground Piping: Concrete pipe anchor sizes and steel reinforcement bars for underground heating water pipes. Calculations shall be signed and sealed by a Professional Engineer registered in the State where project is located.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
   3. Welder's Certificate: Provide certificate of compliance indicating approval of welders prior to any welding. Certificate must be obtained from an independent certification agency, dated within the past 12 months, and must include welders I.D. Number. Test must be for 6G position, E-6010 root and E-7018 filler. Provide photo identification (Driver’s License). Welder must stamp each weld with his I.D.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping" for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.

E. HVAC Water-Treatment Service Provider Qualifications:
   1. An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.
   2. Have a certified “In-House” laboratory capable of performing all analysis required with water system.
   3. Water treatment work shall be supplied by a single provider.

1.7 PERFORMANCE REQUIREMENTS FOR HVAC WATER TREATMENT

A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.

B. Base HVAC water treatment on quality of water available at project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

C. Closed hydronic systems, including chilled water, shall have the following water qualities:
1. pH: Maintain a value within 9.0 to 10.5.
2. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
3. Boron: Maintain a value within 100 to 200 ppm.
4. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
5. Soluble Copper: Maintain a maximum value of 0.20 ppm.
6. TDS: Maintain a maximum value of 10 ppm.
7. Ammonia: Maintain a maximum value of 20 ppm.
8. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
9. Microbiological Limits:
   a. Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
   b. Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
   c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
   d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
   e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

PART 2 - PRODUCTS

2.1 CHILLED WATER PIPING, BURIED

A. Pre-Insulated Pipe: See Pre-Insulated Piping System article below.

B. Steel Pipe: ASTM A53, Schedule 40, 0.375-inch wall sizes for NPS 12 and over, black.
1. Fittings: ASTM A234, forged steel welding type.
2. Joints: AWS D1.1, welded.
3. Casing: Closed glass cell insulation with Pittwrap jacketing.

2.2 CHILLED WATER PIPING, ABOVE GROUND

A. Steel Pipe: ASTM A53 / A53M, Schedule 40, 0.375-inch wall sizes for NPS 12 and over, black, with plain ends.
1. Fittings: ASTM B16.39, malleable iron threaded or ASTM A234 / A234M wrought steel welded. Wall thickness to match adjoining pipe.
2. Joints: NPS 2-1/2 and smaller to be threaded; NPS 3 and larger to be AWS D1.1 welded.
3. Pipe Nipples: Pipe nipples to be Schedule 40 stainless steel.

B. Copper Tubing: ASTM B88, Type L, drawn temper.
1. Fittings: ASME B16.22, wrought copper.
2. Joints: NPS 4 and smaller, Solder. NPS 6 and larger, Brazed.

2.3 EQUIPMENT DRAINS AND OVERFLOWS PIPING

A. Copper Tubing: ASTM B88, Type L, drawn temper.
1. Fittings: ASME B16.22, wrought copper.
2. Joints: NPS 4 and smaller, Solder. NPS 6 and larger, Brazed.

2.4 PRE-INSULATED AND FACTORY CLADDED PIPING SYSTEMS

A. Manufacturers:
1. Basis of Design:
   a. Chilled Water: Thermacor Process, Inc.: Model Ferro-Therm.
   b. Non-Potable Water: Thermacor Process, Inc.: Model Copper-Therm.

2. Insul-Pipe System, Inc.
3. Perma-Pipe, Inc.
4. Ravanco Piping Systems, Inc.
5. Thermal Pipe Systems, LP.

B. Furnish a complete HDPE jacketed system of factory pre-insulated (insulation not required for cladded only systems) piping for the specified service. All pre-insulated pipe, fittings, insulating materials, and technical support shall be provided by the pre-insulated piping system manufacturer.

C. A complete layout of the system, showing anchors, expansion provisions, and building entrance details, shall be provided by the pre-insulated pipe manufacturer.

D. Carrier Pipe:
1. Chilled Water Pipe: Carrier pipe shall be steel ASTM A-53, Grade B., ERW (Type E) or seamless (Type S), standard weight for sizes NPS 2 and larger and shall be ASTM A-106/A-53, standard weight for sizes NPS 1-1/2 and smaller. All carbon steel pipe shall have ends cut square and beveled for butt-welding, except sizes smaller than 2-inch shall be socket-welded. Straight sections of factory insulated pipe shall have 6-inches of exposed pipe at each end for field joint fabrication.
2. Non-Potable Water: Carrier shall be Type K Drawn-Temper Copper tube, conforming to ASTM B-88. All copper piping shall have ends cut square for socket brazing. Straight sections of factory insulated pipe shall have 6-inches of exposed pipe at each end for field joint fabrication. Field joining of piping shall utilize approved methods of brazing with alloys melting at or above 1100°F.

E. Insulation: Polyurethane foam insulation shall be sprayed or injected with one shot into the annular space between carrier pipe and jacket with a minimum thickness as scheduled on chart below. Insulation shall be rigid, 90% closed cell polyurethane with a minimum 2.0 pounds per cubic foot density, compressive strength of 30 psig, and coefficient of thermal conductivity (K-Factor) not higher than 0.18 at 75 deg F per ASTM C-518. Maximum allowable operating temperature shall not be less than 250 deg F.

MINIMUM INSULATION THICKNESS	
Pipe size	Insulation Thickness
NPS 1/2	2.15-inches
NPS 3/4	2.04-inches
NPS 1	1.91-inches
NPS 1-1/4	1.74-inches
NPS 1-1/2	1.62-inches
NPS 2	1.38-inches
NPS 2-1/2	1.77-inches
NPS 3	1.46-inches
NPS 4	1.96-inches

F. Jacketing: Jacketing material shall be extruded, black, high-density polyethylene (HDPE), having a minimum wall thickness of 125 mils for jacket sizes less than or equal to 12-inches, 150 mils for

jacket sizes 12- to 20-inches, and 175 mils for jacket sizes greater than 20-inches. Provide a secure bond between the jacket and foam insulation/pipe preventing any ingression of water at the jacket/ foam interface.

G. Straight run field joints shall be field insulated per the manufacturer's instructions, using polyurethane foam poured in an HDPE sleeve and sealed with heat shrink tape. All joint closures and insulation shall occur at straight sections of pipe. All insulation and jacketing materials shall be furnished by pre-insulated piping system manufacturer.

H. Fittings are factory prefabricated and pre-insulated (insulation not required for jacketed only pipe systems) with polyurethane foam to the thickness specified and jacketed with a one-piece seamless molded HDPE fitting cover, a butt fusion welded, or an extrusion welded and mitered HDPE jacket. Carrier pipe fittings shall be butt-welded, except sizes smaller than 2" shall be socket-welded. Fittings include expansion loops, elbows, tees, reducers, and anchors. Elbows, loops, offsets, or any other direction changes for steel pipe shall conform to the standards set by ASME B31.1, Code for Power Piping.

2.5 WELDED BRANCH AND TAP CONNECTIONS

A. No mitering or notching for fittings allowed. Weldolets or threadolets may be used in lieu of the fittings where branch size is 2 pipe sizes smaller than main unless fittings are noted on the drawings. Forged steel half couplings may be used for drain, vent, and gauge connections.

2.6 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports in accordance with Section 230062 "Hangers and Supports for HVAC Piping and Equipment."

2.7 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos free, spiral wound 1/8-inch maximum thickness unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 150, cast-iron and cast-bronze flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.8 UNIONS, FLANGES AND COUPLINGS

A. Unions for Pipe NPS 2 and Under:
   1. Steel Piping: ASME B16.39, 150 psig malleable-iron, threaded.
   2. Copper Pipe: Wrought-copper unions, ASME B16.22, soldered.

B. Flanges for Pipe NPS 2-1/2 and Above:
   1. Steel Piping: Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
      a. Material Group: 1.1.
      b. End Connections: Butt welding.

2. Copper Pipe: Bronze.
3. Pipe Flange Gasket Materials: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.
    a. ASME B16.21, nonmetallic, flat, asbestos free, spiral wound 1/8-inch maximum thickness unless thickness or specific material is indicated.
    b. Full-Face Type: For flat-face, Class 150, cast-iron and cast-bronze flanges.
4. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Steel Pipe Nipples: ASTM A733, same wall thicknesses as pipe in which they are installed.

2.9 DIELECTRIC FITTINGS

A. Dielectric Nipples:
1. Manufacturers:
    a. Jones Stephens Corp., Series D006-753 through D006-700.
    b. Grinnell Mechanical Products.
    c. Perfection Corp.
    d. Precision Plumbing Products, Inc.
    e. Sioux Chief Manufacturing Co., Inc.
    f. Victaulic Co. of America; Clearflow Dielectric Waterway Style 47.
2. Description:
    a. Standard: IAPMO PS 66.
    b. Electroplated steel nipple. complying with ASTM F 1545.
    c. Pressure Rating: 300 psig at 225 deg F.
    d. End Connections: Male threaded.
    e. Lining: Inert and noncorrosive, propylene

B. Dielectric Flanges:
1. Manufacturers:
    a. Capital Manufacturing.
    b. Central Plastics.
    c. Watts.
    d. Wilkins, a Zurn Company.
2. Description:
    a. Standard: ASSE 1079.
    b. Factory-fabricated, bolted, companion-flange assembly.
    c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

C. Dielectric Flange Insulating Kits:
1. Non-conducting materials for field assembly or companion flanges.
2. Pressure Rating: 150 psig.
3. Gasket: Neoprene or phenolic.
4. Bolt Insulation Sleeves: Phenolic or polyethylene.
5. Washers: Phenolic with steel backing washers

2.10 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:
1. For pipe sizes NPS 2 and smaller: PVC or CPVC, Schedule 80, one-piece fitting; one end with threaded brass insert, and one solvent-cement socket or threaded end.
2. For pipe sizes larger than NPS 2: Flanged joints, provide ductile iron back up flange for plastic pipe.

B. Fitting-Type Transition Couplings:
1. Manufactured piping coupling or specified piping system fitting.

C. HDPE-to-Steel Transition Fittings:
1. For all pipe sizes: Provide HDPE flanged adaptor, with ductile iron back-up ring.

2.11 GATE VALVES

A. Up to and Including Pipe Size NPS 2:
1. Class 125, RS bronze gate valves:
a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron

B. Pipe Size NPS 2-1/2 and Over:
1. Class 150, OS&Y steel gate valves:
a. Standard: MSS SP-70, Type I.
b. NPS 2-1/2 to NPS 14, CWP Rating: 300 psig.
c. Body Material: ASTM A 216 grade WCB, cast steel bolted bonnet.
d. Ends: Flanged.
e. Trim: API Trim 8 with Stellite 6 faced carbon steel seat.
f. Disc: Flexible wedge, ASTM A 217 – CA 15.
g. Packing and Gasket: Asbestos free, spiral wound.
h. Stem: ASTM 276-410 stainless steel.

2.12 GLOBE OR ANGLE VALVES

A. Up to and Including 2 Inches:
1. Class 150, bronze globe valves, and bronze disc:
a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union bonnet.
d. Ends: Threaded.
e. Stem: Bronze, replaceable seat. Rising stem.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron.

B. Over 2 Inches:
1. Class 150, OS&Y iron globe valves
a. Standard: MSS SP-85, Type I.
b. CWP Rating: 300 psig.
c. Body Material: ASTM A 216, grade WCB cast steel with bolted bonnet.
d. Ends: Flanged.
e. Trim: API Trim 8 with Stellite 6 faced carbon steel seat.
f. Disc: ASTM A217-CA15.
g. Stem: ASTM A2776-410 stainless steel.
h. Packing and Gasket: Asbestos free, spiral wound.

2.13 BALL VALVES

A. For Chilled Water Up to and Including pipe size NPS 2:
   1. Manufactures:
      a. Apollo with Therma-Seal insulating tee handle.
      b. Kitz with ISE (insulated stem extension).
      c. Nibco T585-70-66-NS NIB-Seal.
      d. Nexus: (with insulated valve stem) approved for use in conditioned spaces only; field insulate top of valve stem.
   2. Two-piece, full port vented ball with bronze or forged bronze body, blowout proof stem, ASTM A276, Type 316 stainless steel ball, stem, and handle nut; reinforced PTFE packing, thrust washer and seat ring, lever handle with balancing memory stops, solder, or threaded ends. Pressure/temperature to match service requirements, but no less than 250 psig at 250-degree F, SW. 600 psig, CWP. Insulated valve handle extension to clear insulation.

2.14 PLUG VALVES

A. Up to and Including 2 Inches:
   1. Bronze body, bronze tapered plug, full port opening, non-lubricated, Teflon packing, threaded ends.
   2. Operator: One plug valve wrench for every ten plug valves minimum of one.

B. Over 2 Inches:
   1. Cast iron body and plug, full port opening, pressure lubricated, Teflon packing, flanged ends.
   2. Operator: Each plug valve with a wrench with set screw.

2.15 BUTTERFLY VALVES – RESILIENT SEATED

A. Manufacturers: Subject to compliance with specifications as noted herein, provide products by one of the following:
   1. ABZ Valve Model 397.
   2. Centerline Model A2-021-05.
   3. Demco Model NE-C.
   4. Kitz Model 6122E or 6123E.
   5. Mueller Model 88.

B. Standard: MSS-67, Type 1.

C. Body: Class 150 ductile iron, lug pattern, extended neck design to allow for 2” minimum insulation.

D. Liner/Seat: Valves shall be provided with molded-in EPDM liner, bonded and fused to the valve body and hard backed cartridge seat. Liner shall be non-collapsible and stretch resistant to eliminate failure in either pressure or vacuum service, in a design that eliminates possible leakage between body and liner. Valves shall provide full rated dead-end service from 150 pisg to vacuum to 28-inches mercury without the need for a flange on the downstream side.

E. Disc Material: Aluminum bronze.

F. Stem: 410 or 416 stainless steel in order to eliminate leak paths and possible turbulence in flow, stem shall have molded O-ring seals and shall be of the snap ring encapsulated, blowout proof design. Stem to disc engagement shall be of the internally driven design to provide rigid connection between components and eliminate failure under high vibration service. Stem to disc connection via pins, bolts or any external device shall be unacceptable.

G. Packing: EDPM V-type packing shall be utilized in a packing retention design that allows for self-adjustment of packing, eliminate stem leakage and protect around the stem area.

H. Shut Off: Valves shall be certified bubble tight and shall be rated as follows:
1. Valves pipe size NPS 2 to 12 shall be rated to a minimum 200 psi shut off/dead end service.
2. Valves pipe size NPS 14 to 36 shall be rated to a minimum 150 psi shut off/dead end service.

I. Operator: Infinite position locking lever handle shall be provided on valves NPS 4 and smaller. On valves NPS 6 and larger, a worm-gear drive with handwheel shall be included with visual position indicator (MDPI) and shall provide for a positive stop on input shaft to allow for balancing of flow.

J. Valves shall be suitable for 250º F hydronic service.

2.16 BALL VALVES – DIRECT BURIAL

A. Manufacturers: Subject to compliance with Specifications as noted herein, provide product by one of the following:
1. Flowserve Corporation.
2. Vexve Armatury Group

B. Description: Completely insulated and jacketed long-stem, reduced bore ball valves for direct bury application.
1. Body:
a. DN 25–500 Steel, P235GH (1.0345).
b. DN 600–800 Steel, P355 NL1 (1.0566)/ GP240GH (1.0619).
2. Ball:
a. DN 25–600 Stainless steel, X5CrNi18-10 (1.4301).
b. DN 700–800 Steel + stainless plating, ASTM A350 LF2+Ni.
3. Stem: Stainless steel, X8CrNiS18-9 (1.4305).
4. Top of stem: Stainless steel, X5CrNi18-10 (1.4301).
5. Stem seals: FPM.
6. Ball seals: PTFE+C.
7. Equipment: unpainted.
8. Operation: equipped with angle gear, standard hexagon adapter.

C. Insulated and jacketed by Underground Piping System manufacturer.
1. Insulation shall be foam polyurethane or polyisocyanurate and outer jacketing shall be High Density Polyethylene (HDPE).

D. Valve Operator: Angle gear on top, operated with extended T-Key

E. Comply with AWWA M44 for cast iron valve boxes. Include top section, telescopic adjustable extension of length required for depth of burial vale, plug with lettering “CHW” approximately 5-inches in diameter and bottom section with base that fits over valve with barrel.

F. Operating wrenches: Steel, tee handle with one pointed end and socket to match valve operating nut. Length as required to reach deepest buried valve.

2.17 SWING CHECK VALVES

A. Up to and Including NPS 2:
1. Manufactures:
a. Grinnell: Model 3600.
b. Crane.
c. Milvco.
2. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, spring loaded threaded ends, 125 psig WIG.

B. NPS 2 and Larger:

1. Iron body cast steel with bolted cap, bronze trim, bronze, or bronze faced rotating swing disc, renewable disc and seat, flanged ends.
2. Check valve in chilled water decoupler line between the primary and secondary piping loops, to have external indicator.

2.18 AUTOMATIC TEMPERATURE CONTROL VALVES, ACTUATORS, AND SENSORS

A. Comply with requirements specified in Section 230900 "HVAC Instrumentation and Controls."

2.19 WATER TREATMENT FOR CLOSED LOOP SYSTEMS

A. Manufacturers:
1. Chem-Aqua
2. Garratt Callahan
3. Guardian – IPCO, Inc.
4. Nalco Company
5. Triple Point

B. Combination Bypass Feeder and Filter Bag:
1. Manufacturers: Subject to compliance with requirements, provide product by one of the following:
   a. Neptune FTF-5HP with legs and filter bags
2. Steel, with corrosion-resistant exterior coating, minimum 3-1/2-inch (89-mm) fill opening in the top, and NPS 3/4 (DN 20) bottom inlet and top side outlet. Quarter turn or threaded fill cap with gasket seal and diaphragm to lock the top on the feeder when exposed to system pressure in the vessel.
3. Capacity: 7.5 gal.
4. Minimum Working Pressure: 125 psig.
5. 5-micron cleanable bag filter.

C. Water Meter:
1. Manufacturers: Subject to compliance with requirements, provide product by one of the following:
   a. Hersey Measurement Company.
   b. Neptune Technology Group: Model T-10.
2. Description: Nutating disc, positive displacement water meter.
   a. Housing: Corrosion-resistant, no-lead high copper alloy.
   b. Register: Magnetic, low torque, impact.
   c. Connections: Threaded.
3. Size: 5/8", unless noted otherwise in Drawings.

D. Chemicals: Specially formulated, based on analysis of makeup water, to prevent bacteria growth and the accumulation of scale and corrosion in piping and connected equipment.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination or Shop Drawings.

B. Select system components with pressure rating equal to or greater than system operating pressure.

C. Remove scale and dirt on inside and outside before assembly.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. Route piping in orderly manner, parallel to building structure, and maintain gradient.

F. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

G. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

H. Install piping to conserve building space and not interfere with use of space.

I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

J. Install piping to permit valve servicing.

K. Group piping whenever practical at common elevations.

L. Slope piping at indicated slopes and arrange to drain at low points.

M. Install piping free of sags and bends.

N. Install drains, consisting of a tee fitting, NPS ¾ ball valve, and hose end connection with cap, at low points in piping system mains and elsewhere as required for system drainage.

O. Install fittings for changes in direction and branch connections. No mitering or notching for fittings permitted, except as noted below:
   1. Steel Butt Welded Pipe:
      a. For changes in direction of 15 degrees or less, pipe may be mitered.
      b. For change in direction greater than 15 degrees, standard elbow shall be cut to form the required odd angle elbow.
   2. Steel Pipe Branch Connections for Hydronic Piping:
      a. Branch NPS 4 and smaller and at least two pipe sizes smaller than the main, weldolets, threadolets, and sockolets are allowed.
      b. Branch NPS 6 and larger and at least two pipe sizes smaller than the main, sweepolets are allowed.

P. Reduce pipe sizes using eccentric reducer fitting installed with flat side up.

Q. Install piping to allow application of insulation.

R. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

S. Provide access doors where valves and fittings are not exposed. Comply with requirements for building access doors specified in Section 230053 “Basic HVAC Materials and Methods.”

T. Install unions in piping, NPS 2 and smaller, adjacent to automatic valves, pressure reducing valves, at final connections of equipment, and elsewhere as indicated.

U. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

V. Install sleeves for piping penetrations of walls, ceilings, and floors as specified in Section 230053 “Basic HVAC Materials and Methods.”

W. Install escutcheons for piping penetrations of walls, ceilings, and floors in exposed finished spaces. Comply with requirements for escutcheons specified in Section 230053 “Basic HVAC Materials and Methods.”

X. Identify piping as specified in Section 230077 “Identification for HVAC Piping and Equipment.”

Y. Install air vents at all high points in piping, at heat-transfer coils, and elsewhere as required for system air venting as specified in Section 232114 "Hydronic Specialties."

Z. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welds.

AA. Prepare and paint uninsulated pipe, fittings, supports, and accessories, ready for finish painting. Refer to Division 09 Sections "Interior Painting" and "Exterior Painting" for requirements.

3.2 INSTALLATION – UNDERGROUND PRE-INSULATED AND CLADDED PIPING SYSTEMS

A. Underground systems shall be buried in a trench not less than three feet deeper than the top of the pipe. A minimum thickness of 24-inches compacted backfill placed over the top of the pipe.

B. Comply with requirements of Section 312000 "Earth Moving"" and other Division 31 site construction Sections and trench details on Civil Drawings.

C. Trench bottom shall have a minimum of 6-inches of sand. All field cutting of the pipe shall be performed in accordance with the manufacturer's installation instructions.

D. The interior of all pipe, fittings, valves, and accessories shall be kept free from dirt and foreign material. Suitable bulkheads shall be used to block or plug ends of piping at the close of each workday and when work on a particular section of the piping is temporarily discontinued. Should dirt, mud, concrete, or other foreign materials be allowed to enter the piping, such piping shall immediately be cleaned.

E. Each length or section of pipe shall be cleaned immediately before being placed in the trench and joined. Cleaning shall be accomplished by using a tight swab or other suitable cleaning device. Pipe ends shall be wiped clean immediately before the pipe is joined.

F. A hydrostatic pressure test of the carrier pipe shall be performed at one-half times the normal system operating pressure for not less than two hours.

G. Underground piping, joints, and fittings shall not be insulated prior to hydrostatic, or leak testing, of piping system and inspection by Owner's Representative.

H. Underground joints and fittings shall not be backfilled prior to pressure test on closure system and inspection by Owner's Representative.

I. Field Service shall be provided by a certified manufacturer's representative or company field service technician. The technician will be available at the job for a minimum of one day (or more if required by job size) to check unloading, storing, and handling of pipe, pipe installation, pressure testing, field joint insulation, and backfilling techniques.

3.3 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Section 230062 "Hangers for HVAC Piping and Equipment."

B. Pipe Hanger Spacing pipe hanger spacing and hanger rod sizing requirements are specified in Section 230062 "Hangers for HVAC Piping and Equipment."

C. For insulated piping, provide insulation inserts and shields as specified in Section 230712 "HVAC Systems Insulation."

D. For insulated, strut-mounted copper pipe (NPS 1/4 to 4), provide Insulation Couplings per the requirements of Section 230062 "Hangers and Supports for HVAC Piping and Equipment."

E. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

F. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

G. Flanged Joints:
   1. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
   2. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing in wet piping systems. **Do not use dielectric unions**.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.

C. Dielectric Fittings for NPS 2-1/2 and Larger: Use dielectric flange kits.

3.6 VALVE APPLICATIONS

A. Install shutoff-duty valves at supply and return connections to each piece of equipment and elsewhere as indicated.

B. Install check valves at each pump discharge and elsewhere as required to control flow direction.

C. If valve applications are not indicated on the Drawings, use the following:
   1. Shutoff Service: Ball, butterfly valves.
   2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
   3. Throttling Service: Globe, ball, or butterfly valves.
   4. Pump-Discharge Check Valves:
      a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
      b. NPS 2-1/2 and Larger: Iron swing check valves with spring or iron, center-guided, resilient-seat check valves.

D. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Pipe outlet without valves to the drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

E. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, adjacent to each valve control valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

B. Wet Piping Systems: Install dielectric fittings to connect piping materials of dissimilar metals.

C. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

D. Install control valves in accessible locations close to connected equipment.

E. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Section 230122 "Meters and Gages."

3.8 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe, not inverted.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for butterfly, gate, globe, and plug valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 80 inches above finished floor.

F. Install check valves for proper direction of flow and as follows:
   1. Swing Check Valves: In horizontal position with hinge pin level.
   2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.

3.9 INSTALLATION – DIRECT BURIAL BALL VALVES

A. Install valves per manufacturer's instructions.

3.10 PIPE CLEANING AND FLUSHING

A. Keep pipe clean and free of dirt. Keep caps on ends of pipe, or covered with 6-mil plastic, when it is stored on site and reinstall caps on ends of installed piping at the end of each day.

B. On bench work making up fittings and when installing fittings, wipe slag out of ends of pipe where accessible from the open end.

C. Tap and bump long pieces of pipe to knock loose welding slag inside pipe out of the open end.

D. Prior to closing up piping system, piping shall be flushed, blown, or pigged as necessary to provide clean systems.

E. Underground Piping System – Additional Requirements:
   1. Contractor to submit a piping cleaning plan, process, and schedule for cleaning the underground piping system.
      a. Coordinate flushing and cleaning process with Commissioning Authority.
   2. Contractor to provide temporary pipe, fitting and pumps as required.
   3. Pump circulation rate (gpm) to be as recommended by Chemical Treatment Supplier.

4. Pipes shall be flushed to low points.

F. When flushing and cleaning the pipe, provide a bypass at coils (air handlers, fan coil units, air terminal units, etc.) and heat exchangers (includes brazed, shell-in-tube or plate and frame heat exchangers at packaged air-cooled chillers and self-contained water-cooled AC unit, etc.) with full size hoses or PVC pipe until cleaning process is complete.

G. Complete flush and cleaning of piping system as directed by chemical treatment and Commissioning Agent technician, being certain to keep strainers clean and removing start-up strainers at pumps after pipe cleaning is complete.

H. When connecting new pipe to existing system, provide temporary pump, piping, valves, cartridge filter (5 microns), and one-shot chemical feeder. New piping system to be flushed, cleaned, and treated prior to opening to existing piping system.

3.11 FIELD QUALITY CONTROL

A. Leave joints, including welds, uninsulated and exposed for examination during test.

B. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
4. Isolate expansion tanks and determine that hydronic system is full of water.
5. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
6. Duration: 6 hours without evidence of leakage.
7. Correct or replace defective workmanship or materials shown by tests and retest as necessary to insure tightness.
8. Prepare written report of testing.

C. Perform the following before operating the system:
1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.

3.12 WATER TREATMENT FOR ALL CLOSED LOOP SYSTEMS

A. General:
1. Water treatment chemical supplier for thermal water piping systems shall work with the Contractor to ensure that all thermal water piping and HVAC systems are properly flushed, cleaned, and passivated.
2. Install water meter in the make-up water line serving each closed loop piping system.
3. After completion of installation and leak test, fill, clean/flush and treat system.
4. Prepare, and submit for approval, pipe flushing, cleaning and treatment plan. Commissioning Authority shall approve plan and witness process.

B. Pipe Cleaning:
   1. Install combination bypass filter and chemical feeder in a bypass circuit around the circulation pumps, unless otherwise indicated on the Drawings.
   2. Coordinate with Mechanical Contractor to provide required bypass piping, valves, etc. prior to flushing and cleaning of piping systems.
      a. Provide bypass piping around all coils and control valves prior to fill and flush operation.
      b. Provide spool pieces in place of all inline flow meters during testing, cleaning, and flushing operations.
   3. Start pipe cleaning process with 50-micron filters and move down to 25-micron filters as system is cleaned. Final filters shall be 5-micron.
   4. Provide temporary crossovers and temporary pumps as required for cleaning new work before valves at connections to existing work are opened. Minimum cleaning flow rates to provide water velocity of 4 feet per second.

Minimum Cleaning Water Flows	
Pipe Size (NPS)	Flow (GPM)
4	150

C. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling.

D. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

E. After initial flushing and cleaning, open coils up to system, complete cleaning, and addition of biocide.

F. Underground Piping System – Additional Requirements:
   1. Pipe shall be flushed and treated no more than one week after initial cleaning.

G. Water treatment provider shall provide a minimum of twice weekly service and analysis during the first two weeks after start-up and a minimum of monthly service for the first year after Substantial Completion. Service visits to include chemical analysis of closed loop systems, adjusting chemistry as required and changing dirty cartridge filters and blowing down the air dirt separator. Provide Owner with written report of findings and/or actions taken during the monthly service visits.
   1. Initial blow downs of air/dirt separator to be into a barrel until most of the dirt/trash are removed. (Do not pour dirt down the floor drain.)

END OF SECTION 23 2113

SECTION 23 2114

HYDRONIC SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Expansion tanks.

B. Air control devices.

C. Air and dirt separators.

D. Strainers.

E. Pump suction fittings.

F. Venturi flow meter.

G. Hose kits.

H. Relief valves.

I. Flexible connections.

J. Venturi balancing valve.

1.2 RELATED SECTIONS

A. Section 230900 “HVAC Instrumentation and Controls” for Automatic Temperature-Control Valves and Actuators.

1.3 DEFINITIONS

A. Branch Line: As related to the requirements for installing automatic versus manual air vents, a branch line is any runout that services only one terminal unit.

1.4 ACTION SUBMITTALS

A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model, and dimensions.

1.5 INFORMATIONAL SUBMITTALS

A. Operation and Maintenance Data: For air control devices and hydronic specialties, s to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 BLADDER-TYPE EXPANSION TANKS

A. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Armstrong.

2. Bell & Gossett.
3. Elbi of America.
4. Taco.
5. Wheatley.

B. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory tested, precharge with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

C. Bladder: flexible heavy-duty butyl bladder (removable). Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.

D. Steel support stand for floor mounted units.

E. Accessories: Air-charging fitting; precharge to 12 psig.

F. Automatic Cold-Water Fill Assembly: Pressure reducing valve, check valve, strainer, and valved bypass.
1. Pressure reducing valve adjustment range to be as required to obtain scheduled expansion tank pressure.

2.2 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide one of the following:
1. Armstrong.
2. Elbi of America.
3. Hoffman Model 79.
4. Watson-McDaniel.
5. Wheatley.

B. Manual Air Vents:
1. Body: Bronze.
2. Internal Parts: Stainless Steel Ball.
3. Operator: Lever.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 15- psig.
7. Maximum Operating Temperature: 225 deg F.

C. Automatic Float Type:
1. Body: cast iron.
2. Internal Parts: Stainless Steel.
3. Operator: Stainless Steel metal float.
4. Inlet Connection: NPS ½ with ball valve.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 150-psig.
7. Maximum Operating Temperature: 240 deg F.

2.3 AIR AND DIRT- TYPE SEPARATOR

A. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Armstrong: DAS-R and DASH-R.
2. Bell & Gossett: CRS.
3. Elbi of America.

4. Spirotherm: Dirt and Drain.
5. Taco.
6. Thrush: Aar-O-Vent.
7. Wessels: Series Wess-Vent.

B. Description: In-line coalescing type air and dirt separator with removable head.
1. Shell: Carbon steel with exterior red oxide primer finish.
a. Inlet and Outlet Connections: Threaded for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger.
b. Tank: Flanged; ASME constructed and labeled for 150-psig minimum working pressure and 375 deg F maximum operating temperature.
c. Coalescence Media: Integral 304 stainless steel or copper bundle of spiral wound tubes, constructed to direct released air into expansion tank and collect dirt.
2. Blow down connection with bronze ball valve with stainless steel ball and shaft.
3. Skim/flush connection with bronze ball valve with stainless steel ball and shaft.
4. High capacity, float actuated air vent with ball valve isolation valve.
5. Inlet and outlet gauge ports.

C. Rating: Remove 99% of dissolved oxygen and 96% of dirt particles 5-microns and larger.

D. Sizing: Air and dirt separator shall be sized per manufacturer's recommendations. Maximum pressure drop for sizes 2-inch to 12-inch shall not exceed two feet of water for standard velocity units and three feet of water for high velocity units.

2.4 STRAINERS

A. Body 2-inch and smaller:
1. Screwed brass or iron body by 175 psig working pressure, Y pattern with 1/32-inch stainless steel perforated screen.

B. Size 2-1/2-inch to 4 -inch:
1. Flanged iron body for 175 psig working pressure, Y pattern with 3/64-inch stainless steel perforated screen.

C. Strainer Screen: 40-mesh startup strainer. Liquid service 3-inch and smaller, 20 mesh screen, 4-inch and larger, 3/64-inch diameter.

2.5 PUMP SUCTION FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide one of the following:
1. Armstrong.
2. Aurora.
3. Bell & Gossett.
4. Mueller.
5. Taco Model SD.
6. Wheatley Model FD.

B. Fitting: Angle pattern, cast-iron or ductile body, threaded or flanged for 2-inch and smaller, flanged for 2-1/2-inch and larger, rated for 175-psig working pressure, with bronze or stainless-steel straightening vanes, 304 stainless steel cylinder strainer with 3/16-inch diameter openings, bronze disposable fine mesh start-up strainer to fit over bronze or stainless-steel permanent cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.

C. Accessories: Adjustable foot support, blowdown tapping in bottom, gage tapping inside.

2.6 VENTURI FLOW METER

A. Manufacturers: Subject to compliance with requirements, provide one of the following:
   1. Armstrong.
   2. Flow Design.
   3. Gerand.
   4. Presco.
   5. Taco.

B. Venturi Flow Meter: 150 psig WP. Venturi Flow Meter, bronze, screwed 2-inch and smaller; steel, butt-welded in sizes 2-1/2-inch and larger, 3% accuracy over 10:1 range, maximum line pressure drop not exceeding 1-foot. Provide quick connect 1/8-inch MNPT x ¼-inch brass ball valve process connections with 2.5-inch brass extensions. Provide stainless steel ID tag for each meter indicating manufacturer, model, size, design flow, design differential pressure. Submit meter differential pressure vs flow graph.

C. Portable differential pressure meter consisting of case containing 10-foot color coded hoses for low- and high-pressure connections, and connectors suitable for connection to read-out valves.

2.7 HOSE KITS

A. Manufacturers: Subject to compliance with requirements, provide one of the following:
   1. Flow Design, Inc.
   2. Twin City Hose.
   3. Nexus.

B. Hose:
   1. Inner Hose: Fire retardant thermoplastic tube.
   2. Exterior Sleeve: Stainless steel, braided.
   3. Pressure Rating: 600 psig at 230F.
   4. Length: As required for installation: Minimum 12-inches and maximum 24-inches.
   5. Brass End Fittings:
      a. One end fixed male screw.
      b. One end with swivel female with nipple (MxM).
      c. Inverted flare nipple, “washerless design.”

C. Venturi Balancing Valves – See respective articles, this section.

D. Automatic Valve – see Section 230900 “HVAC Instrumentation and Controls.”

2.8 RELIEF VALVES

A. Bronze body, Silicone seat, stainless steel stem and springs, automatic, direct pressure actuated, capabilities ASME certified and labeled.

2.9 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide one of the following:
   1. Flexonics.
   2. Hypsan.
   3. Keflex.
   4. Southeastern Hose.
   5. Twin City Hose.

B. Laminated 2-ply corrugated 304 stainless steel joints designed for 150 psig WP. Joints shall be flanged and have not less than 5” relaxed face-to-face dimension.

C. For each joint furnish a control unit consisting of tie bolts with required nuts, spacers, washers and stop and lock nuts.

D. All thread rods shall not be used for tie bolts. Nuts and bolts for joints in chilled water lines shall be type 304 stainless steel.

2.10 VENTURI BALANCING VALVE

A. Manufactures: Subject to compliance with requirements, provide one of the following:
1. Flow Design Inc., FlowSet.
   a. Size ½ inch to 2 inch: Model UA-SBS.
   b. Size 2-1/2 inch to 18 inch: Model AF or AW (Model AG (grooved pipe) only allowed when specified under specific piping system).
2. Bell & Gossett.
3. Griswold Controls.
4. Nutech.
5. Nexus.
6. Preso.

B. Design: Manual balancing devices shall be venturi type as defined by ASHRAE. Devices shall have a precision machined throat and have a stated catalog accuracy of 3% full scale. The induced differential reading (flow signal) shall be greater than two feet water column at the design flow with the valve in the wide-open position. The valves are to have differential readout ports fitted with 2" extensions, check valve, and protective cap, and are to have a memory stop to allow complete shut-off and return to set position without losing the setpoint.

C. Construction:
1. All devices, 2" and smaller, shall have a machined brass venturi section and a throttling ball valve with a memory stop on the downstream side of the venture. The ball valve shall have a brass or bronze body, blowout proof stem, type 316 stainless steel ball, stainless steel stem, virgin Teflon seats, brass stem and packing nut and a steel handle.
   a. Thread or sweat connections.
2. Valves 2" and larger, shall have a venturi section and a throttling butterfly valve with a memory stop. Butterfly valve shall meet the specification requirements for ball valves in Section "Hydronic Piping."
   a. Flanged connections.

D. Minimum Ratings:
1. Devices with sweat or NPT connections: 400 PSIG at 250 degrees F.
2. Devices with flanged connections: 200 PSIG at 250 degrees F.

E. Installation:
1. The upstream and downstream straight pipe required to achieve 3% full scale accuracy shall be incorporated as an integral part of the venturi and valve assembly. No additional straight piping shall be required.

F. Accessories:
1. Provide factory fabricated insulation kit with handle cover and accessory extensions.
2. Provide tag attached to each valve with brass or stainless-steel chain indicating the following:
   a. Manufacturer.
   b. Size and model.
   c. Differential pressure at design flow.
3. Submit with flow versus differential pressure drop for each valve size with Closeout Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Air Vents:
   1. In piping mains, provide automatic air vents at piping high points and as indicated on the Drawings.
      a. For automatic air vents, provide 1/4-inch, Type L soft copper vent tubing to nearest drain.
   2. In piping branches and at heat-transfer coils, provide manual air vents at piping high points and as indicated on the Drawings.

C. Air Eliminator and Dirt Separators:
   1. Provide full port stainless-steel ball valves at blow down and flush/skim connections, if not provide with unit.
   2. Pipe blow down and flush/skim valves line size to floor drain.
   3. Pipe air vent outlet with ¼-inch copper tube to floor drain.
   4. Provide inlet and outlet valves to isolate unit, with a line-size, valved bypass around separator.
   5. Install unit to allow sufficient clearance below unit to remove coalescing media when bottom cover is removed.
   6. Upon initial start-up, the blow down and skim valves should be operated frequently.
   7. Provide pressure gauge with valved taps at inlet and outlet pipe.

D. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS ¾ nipple and ball valve with hose end connection in blowdown connection of strainers.

E. Support pump fittings with floor mounted pipe and flange supports.

F. Relief Valves:
   1. Provide relief valves on heat exchangers.
   2. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
   3. Pipe relief valve outlet to nearest floor drain.
   4. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

G. Hose Kits: Install without loops or excess length and so that hose is not under tension or compression forces.

END OF SECTION 23 2114

SECTION 23 3113

METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg. Metal ducts include the following:
   1. Sheet metal materials.
   2. Single-wall rectangular ducts and fittings.
   3. Single-wall round and flat-oval ducts and fittings.
   4. Sealants and gaskets.
   5. Hangers and supports.

1.2 RELATED SECTIONS

A. Section 230553 “Identification for HVAC Piping and Equipment” for labeling requirements for fire dampers, smoke dampers, and duct access doors.

B. Section 230593 “Testing, Adjusting and Balancing” for testing, adjusting, and balancing for metal ducts.

C. Section 230712 “HVAC Systems Insulation” for duct liner requirements.

D. Section 233300 “Duct Accessories” for dampers, sound-control devices, duct-mounted access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:
   1. Sealants and gaskets.

B. Shop Drawings: Drawn to 1/4-inch equals 1-foot scale.
   1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
   2. Factory-and shop-fabricated ducts and fittings.
   3. Duct layout indicating sizes, configuration, liner material, seal classification, and static-pressure classes.
   4. Elevation of bottom of ducts.
   5. Dimensions of main duct runs from building grid lines.
   6. Fittings.
   7. Reinforcement and spacing.

8. Seam and joint construction.
9. Penetrations through smoke barriers and fire-rated construction.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including access doors and dampers.
12. Hangers and supports, including methods for duct and building attachment.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to a scale large enough to indicate and resolve conflicts, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services including:
      a. Suspended ceiling components.
      b. Other systems installed in same space as duct.
      c. Ceiling and wall mounting access doors and panels required to provide access to dampers and other operating devices.
      d. Ceiling mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
   2. Indicate proposed changes to duct layout.
   3. Provide Coordination Drawings for the following areas:
      a. Mechanical Room.

B. BIM: Provide a 3D BIM model to indicate and resolve conflicts in which the following items are shown and coordinated based on input from installers of the items involved:
   1. Duct installation indicating coordination with general construction, building components, and other building services including:
      a. Suspended ceiling components.
      b. Other systems installed in same space as duct.
      c. Ceiling and wall mounting building access doors and panels required to provide access to dampers and other operating devices.
      d. Ceiling mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
   2. Indicate proposed changes to duct layout.

1.6 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections, including pitting, dents and other imperfections including those which would impair post painting.

C. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G90.
   2. Finishes for Surfaces Exposed to View: “Paint Grip” steel - Mill phosphatized or galvanealed.

D. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

E. Stainless Steel: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the Part 3 "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B finish for concealed ducts and No. 4 finish for exposed ducts.

F. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

G. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized where installed on galvanized sheet metal ducts.
   1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

H. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 900 mm 36 inches.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible.”

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible.”

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible.”

E. Duct sizes shown on the Drawings are clear inside dimensions without an allowance for insulation.

2.3 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Eastern Sheetmetal.
   2. Linx Industries, Inc.
   3. McGill AirFlow LLC.
   4. SEMCO Incorporated.
   5. Sheet Metal Connectors, Inc.

6. Spiral Systems., Inc.

C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Transverse Joints in Duct Larger than 60 Inches in Diameter: Flanged.

E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

F. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

G. Fabricate elbows using die-formed, gored, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter unless noted otherwise on drawings. Unless elbow construction type is indicated, fabricate elbows as follows:
1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards-Metal and Flexible," Table 3-1 "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments unless otherwise indicated.
   a. Elbows 12-inches and Smaller in Diameter: Stamped.
   b. Elbows 14-inches and Larger in Diameter: Welded

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, Plus and Minus.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Solvent-Based Joint and Seam Sealant:
1. Application Method: Brush on.

2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L (less water).
10. Maximum Static-Pressure Class: 10-inch wg, Plus and Minus.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant:
1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of0.14 L/s per sq. m at 250 Pa 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, Plus or Minus.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel all-thread rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

3. Supports for Aluminum Ducts: Aluminum, or galvanized steel coated with zinc chromate.

I. Roof Mounted Supports:
1. Duct support systems installed on roof shall be equal to Cooper B-Line: Dura-Block system of plastic bases supports and strut frames.
2. Bases: Injection molded and pressed, plastic and rubber. Bases shall be 18-inch x 18-inch, shop fabricated with inserts for square tubing or threaded rods as required.
3. Framing: 1-5/8-inch or 1-7/8-inch galvanized strut fabricated of steel conforming to ASTM A570, Grade 33. Framing shall be roll formed of 12-gauge steel 3 sided or tubular shaped. Tubing shall be perforated with 9/16-inch holes at 1 7/8-inch centers on 3 sides.
4. Accessories: Provide all clamps, bolts, nuts, washers, and other devices as required for a complete system.
5. Strut Coatings:
   a. Shall be hot dip galvanized. Galvanizing shall conform to ASTM A123 for tubing and ASTM A153 for hardware and accessories, or
   b. High-performance factory applied electro-deposition acrylic coating Unistrut Perma-Green III, electro-deposition epoxy coating Dura Green by Eaton/Cooper B-Line, or approved equivalent.

J. Refer to Section 230529 “Hangers and Supports for HVAC Piping and Equipment,” for additional requirements.

PART 3 - EXECUTION

3.1 DUCT CLEANLINESS

A. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines" and the following:
1. Delivery to Site:
   a. Prevent damage during transportation and off-loading
   b. All duct shall be sealed either by blanking or capping duct ends, bagging small fittings, surface wrapping or shrink wrapping.
2. The area provided for storage shall be clean, dry and exposure to dust minimized. Cover duct stored on construction site with 6 mil plastic.
3. Installation:
   a. Work area shall be clean, dry, and protected from the elements.
   b. Internal surface of uninsulated duct shall be wiped immediately prior to installation.
   c. Open ends on completed work and overnight work-in-progress shall be sealed.
4. Replace internal duct liner that gets wet.

3.2 DUCT INSTALLATION - GENERAL

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts with fewest possible joints.

D. Install factory or shop-fabricated fittings for changes in direction, size, and shape and for connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a minimum clearance of 1-inch, plus allowance for insulation thickness.

H. Route to avoid passing through transformer vaults, electrical equipment rooms and enclosures, data closets, and elevator machine rooms.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Where ducts pass through fire-rated interior partitions and exterior walls or smoke barriers, install fire dampers, smoke dampers or combination fire and smoke dampers as required. Comply with requirements in Section 233300 “Duct Accessories” for fire and smoke dampers.

3.3 EXPOSED DUCTWORK - ADDITIONAL INSTALLATION REQUIREMENTS

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.4 HANGERS AND SUPPORTS INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports.”

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 100 mm4 inches thick.
   4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
   5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1M Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 1200 mm48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports or as shown on the Drawings.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

G. Roof Mounted Duct Support System:
1. Verify that roofing system is complete and that roof surfaces are smooth and flat and are ready to receive work.
2. Verify that roof temperature is a minimum of 60 degrees F for proper adhesive performance.
3. Use care in installation of duct support systems not to damage roofing, flashing, equipment, or related materials.
4. Clean surfaces of roof to receive duct support bases. Remove gravel from gravel surfaced roofs, remove dirt, dust, oils, and other foreign materials from all roofs. Prime existing membrane with a primer that is compatible with existing components in the roofing system.
5. Bases and support framing shall be located as indicated on the drawings and as specified herein. The support of all ductwork shall be complete and adequate, whether or not all required devices are shown.
6. Set bases with adhesive in accordance with manufacturer's installation instructions. Accurately locate and align bases. Where applicable, replace gravel around bases. Install strut framing as required to properly support ductwork.

3.5 CONNECTIONS

A. Make connections to air handlers and fans with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Make connections to air terminal units as shown on the drawings.

C. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in Part 3 "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal Classes:
1. Seal Class A: Seal all transverse joints, longitudinal seams, and duct wall penetrations.
2. Seal Class B: Seal all transverse joints and longitudinal seams.
3. Seal Class C: Seal all transverse joints.

C. All connections shall be sealed under all Seal Classes, including but not limited to spin-ins, taps, other branch connections, access doors, access panels, and duct connections to equipment. Sealing that would void product listings is not required. Spiral lock seams need not be sealed.

D. Seal ducts and perform leak tests (where scheduled in Part 3, Article "Field Quality Control below") prior to concealment of any portion of the duct systems and before external insulation is applied.

E. Spiral Duct Transverse Joints: Joints made with gasketed slip connections meeting leakage Class 4 do not require additional sealing when installed in accordance with the manufacturer's instructions.

3.7 DUCT SCHEDULES

A. Ductwork General: Unless otherwise noted, construct ductwork, fittings, and transitions according to the following schedule:

AIR SYSTEM	MATERIAL	PRESSURE CLASS	SEAL CLASS

Rectangular Supply Duct Before Air Terminal Units	Galvanized	Plus 4-inches wg	A
Round and Flat Oval Supply Duct Before Air Terminal Units	Galvanized Spiral Duct	Plus 4-inches wg	A
Supply Duct After Air Terminal Units	Galvanized	Plus 1-inch wg	C
Low Pressure Supply Ducts	Galvanized	Plus 1-inch wg	C
Return Ducts – Low Pressure	Galvanized	Minus 1-inch wg	C
General Exhaust Ducts	Galvanized	Minus 1-inches wg	C
Transfer Ducts	Galvanized	Minus 1-inch wg	C
Round Supply, Return and General Exhaust Duct – Low Pressure; Size > 14-inch Diameter	Galvanized Spiral Duct	Minus 2-inch to Plus 2-inches wg	C
Round Supply, Return and General Exhaust Duct – Low Pressure; Size ≤ 14-inch Diameter	Galvanized Snap Lock– Min 26 gauge	Minus 1-inch to Plus 1-inch wg	C
Low pressure Supply, OSA Supply, Return and General Exhaust Duct Risers Which Penetrate More Than One Floor	Galvanized	Minus 1-inch to Plus 1-inch wg	B
Notes: 1. Supply duct before the air terminal unit is duct installed between the air handler and the air terminal unit.			

B. Elbow Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
      a. Velocity 1000 fpm or Lower:
         1) Radius Type RE 1 with minimum 0.6 radius-to-diameter ratio.
      b. Velocity 1000 to 1500 fpm:
         1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      c. Velocity 1500 fpm or Higher:
         1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
   2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
      a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered

Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.6 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Welded.

C. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch – Low pressure: Spin in.
c. Rectangular Main to Round Branch – Exceeding 3-inch pressure class: Conical tap.
d. Rectangular Main to Round Branch where main depth is less than 2-inches taller than branch diameter: 45-degree entry with square to round.
e. Provide damper in all low-pressure branch connections.
2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity 1500 fpm or Higher: 45-degree lateral.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections prior to the use or concealment of any portion of a duct system. Ducts shall be considered to be concealed where installed in shafts or covered by coatings or wraps that prevent the ductwork from being visually inspected on all sides.

B. Duct Leakage Tests:
1. Comply with ASHRAE/SMACNA Standard 126 “Method of Testing HVAC Air Ducts and Fittings.” Submit a test report for each test.
2. In paragraphs below specifying which ductwork is to be leak tested, where representative sections to be tested are specified to be only 25-percent of the total duct area installed of the system to be tested, then the following “25-50-100” methodology shall be followed:
a. Should the tested 25-percent fail to meet the requirements of this article, then 50-percent of the total installed duct area shall be tested.
b. Should the tested 50-percent fail to meet the requirements of this article, then 100-percent of the total installed duct area shall be tested.
3. All sections to be tested shall be selected by the building owner or the owner’s representative.
4. Test the following duct systems:
a. Ducts specified to have Class A seal: Test representative duct sections totaling no less than 100-percent of total installed duct area for the designated duct systems.
5. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.
6. No leaks shall be audible.
7. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated on Drawings, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.

8. Positive pressure leakage testing is acceptable for negative pressure ductwork.
9. Maximum allowable leakage (L_{max}) shall be calculated as follows:

$$L_{max} = C_L(P)^{0.65}$$

Where:

L_{max} = maximum permitted leakage in cfm/100 ft^2 duct surface area.

C_L = duct leakage class, cfm/100 ft^2 at one in. wg.

6 for rectangular sheet metal, rectangular fibrous, and round flexible ducts.

3 for round/flat overall sheet metal or fibrous glass ducts.

P = test pressure, which shall be equal to the design duct pressure class rating in inches of wg.

	Leakage Class (C_L) = CFM Leakage per 100 ft^2 @ 1-inch wg		
SEAL CLASS	C	B	A
RECTANGULAR METAL	24	12	6
ROUND METAL	12	6	3

3.9 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Sections 099113 "Exterior Painting" and 099123 "Interior Painting."

3.10 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC.

END OF SECTION 23 3113

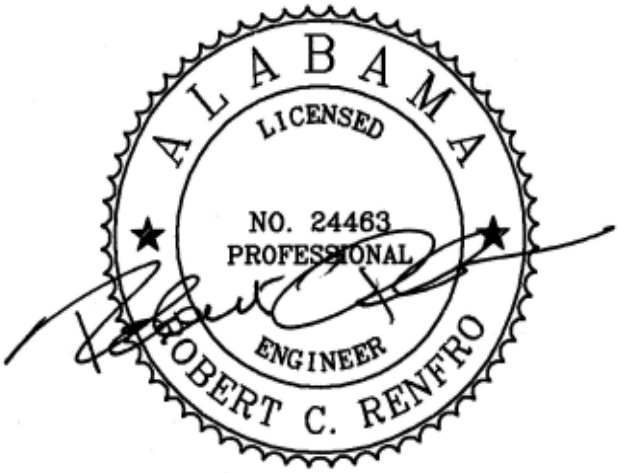
SECTION 26 00 00

COVER - RCR

DIVISION 26/27/28

ELECTRICAL SPECIFICATIONS

PREPARED BY



4/27/2026

SECTION 26 05 00

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 DESCRIPTION

A. General Conditions:
1. The accompanying General Conditions (front-end specifications) shall apply to and form a part of this section.

B. General Requirements:
1. Carefully examine General Conditions, other specification sections, and other drawings (in addition to Electrical) in order to be fully acquainted with their effect on electrical work.
2. Do all work in compliance with all applicable codes, laws, and ordinances, the National Electrical Safety Code, the National Electrical Code (hereinafter referred to as "Code"), applicable energy codes, and the regulations of the local utility companies. Obtain and pay for any and all required permits, inspections, certificates of inspections and approval, and the like.
3. Cooperate with other trades and contractors at job. Perform work in such manner and at such times as not to delay work of other trades. Complete all work as soon as the structure and installations of equipment will permit. Patch, in a satisfactory manner and by the proper craft, any work damaged by electrical workmen.
4. Electrical contracting firm shall be licensed as an electrical contractor in the state where work will be performed

1.2 GENERAL SCOPE OF ELECTRICAL WORK (REFER TO DRAWINGS FOR OTHER SPECIFIC SCOPE ITEMS)

A. Furnish all labor and materials to complete electrical work as shown on drawings and/or herein specified.

B. Remove all existing electrical equipment and wiring made obsolete by this project and remove or relocate all electrical services located on or crossing through the project property, either above or below grade, which would obstruct the construction of the project or conflict in any manner with the completed project or any code pertaining thereto. Dispose of salvageable materials as directed by the Architect. Contractor shall schedule meeting to review scope of electrical demolition and to confirm scope and phasing of proposed demolition with the owner in the presence of the prime consultant prior to start of any electrical demolition.

C. Furnish and install complete power, telephone and other electrical services as shown on drawings and/or specified herein.

D. Pay all electrical utility company service charges (if any) in connection therewith, including permanent meter deposit. Meter deposits will be refunded to Contractor at time of Owner's acceptance.

E. Furnish and install complete power distribution system as shown on drawings and/or specified herein.

F. Furnish and install disconnect switches for motors as shown on drawings and/or specified herein.

G. Furnish and install complete electrical grounding systems as shown on drawings and/or specified herein.

H. Install and connect electrical equipment mentioned in Division 26/27/28 Specifications or noted in drawings, whether furnished by electrical contractor or by others.
1. Where shown or specified, equipment furnished by others shall be installed and connected under this Contract.
2. Where shown or specified, Contractor shall receive, unpack, check and assume custody of equipment furnished by Others. Contractor shall assume responsibility for care and safekeeping of this equipment, when delivered into his custody. He shall protect it from moisture, dust and damage during construction and until Owner acceptance of project.

I. Furnish and install complete electrical lighting systems as shown on drawings and/or specified herein.

J. Furnish and install all electrical items shown on drawings and/or herein specified, unless shown or specified otherwise.

K. Furnish and install complete controls & auxiliary systems as shown on drawings and/or specified herein.

L. Furnish and install complete telephone/data raceway (including all outlet boxes, face plates, conduit raceways, telephone backboards, terminal cabinets, etc.), wiring and devices system as shown on drawings and/or specified herein.

M. Furnish and install a complete Fire Alarm System as shown on drawings and/or specified herein.

N. Furnish and install a complete Surge Protection System as shown on drawings and/or specified herein.

O. Furnish and install a complete Building Lightning Protection System as shown on drawings and/or specified herein.

P. Procure and pay for permits and certificates as required by local and state ordinances and fire underwriter's certificate of inspection.

Q. Balance loads as equally as practicable on services, distribution feeders, circuits and buses. Provide typewritten directory for each panel.

R. Unless specifically indicated or required otherwise, terminate all circuitry/cabling provided within this contract at associated equipment/devices/etc. in accordance with all applicable codes, standards and supplier requirements, whether associated equipment/device/etc. is furnished within this contract or by others.

S. Complete field testing, adjustment & startup of all systems listed above as shown on drawings and/or specified herein.

PART 2 - PRODUCTS

2.1 APPROVED MATERIALS AND DEVICES

A. Where not otherwise specified, provide only new, standard, first-grade materials/systems throughout, conforming to standards established by Underwriter's Laboratories, Inc., and so marked or labeled, together with manufacturer's brand or trademark. All equipment/systems subject to approval of Architect before installation. All like items and associated equipment/systems shall be of one manufacturer.

B. To ensure proper coordination, it is intended that all electrical equipment and materials specified in Division 26/27/28 of these specifications and shown on the electrical drawings be furnished and installed by the electrical sub-contractor. It will not be permissible for any of these items to be furnished directly by the general contractor without the electrical contractor's coordination.

C. To ensure commonality of spare parts, it is required that the electrical contractor provide the same brand for all circuit breakers, starters, power equipment, etc. provided under the following divisions of these specifications:
1. SECTION 26 24 16: POWER PANELBOARDS - CIRCUIT BREAKER TYPE
2. SECTION 26 24 17: LIGHTING PANELBOARDS
3. SECTION 26 28 16: SAFETY SWITCHES AND FUSES

2.2 SUBMITTALS

A. All submittals to the design team shall be accompanied by a letter summarizing all proposed deviations from specified products or pre-approved substitutions. The absence of such a letter shall be understood to indicate that the contractor intends to meet all contract requirements, regardless of cut-sheets/data-sheets provided within the submittal.

B. Submit to Architect ten (10) days prior to bid date three (3) copies of any items and/or manufacturers which are proposed as substitutes for those specified.

C. Submit to Architect promptly after award of Contract and prior to purchasing, the number of copies required by the contract. All drawings of a specific item or system shall be made in one submittal, and within thirty (30) days after award of Contract. Shop drawings of all power equipment shall contain exact details of device placement, phasing and numbering, in form of elevations, for each major piece of equipment. Shop drawings shall be submitted on the following:
1. SECTION 26 05 36: CABLE TRAYS
2. SECTION 26 09 43: LIGHTING CONTROL SYSTEM
3. SECTION 26 24 16: POWER PANELBOARDS - CIRCUIT BREAKER TYPE
4. SECTION 26 24 17: LIGHTING PANELBOARDS
5. SECTION 26 28 16: SAFETY SWITCHES AND FUSES
6. SECTION 26 41 00: LIGHTNING PROTECTION SYSTEM
7. SECTION 26 43 00: SURGE PROTECTIVE DEVICES
8. SECTION 26 50 00: LIGHTING MATERIALS AND METHODS
9. SECTION 27 10 00: STRUCTURED CABLING SYSTEM
10. SECTION 28 20 00: CCTV SURVEILLANCE SYSTEM - IP
11. SECTION 28 31 00: FIRE ALARM SYSTEM

12. SECTION 28 78 00: EMERGENCY RESPONDER RADIO COVERAGE SYSTEM
13. ALL POWER DISTRIBUTION EQUIPMENT (i.e. SWITCHBOARDS, PANELBOARDS, DRY TYPE TRANSFORMER, ETC.)
14. ALL ELECTRICAL AND TELECOMMUNICATION EQUIPMENT LAYOUTS - Submittals shall include ¼" = 1'-0" CAD drawings (hand drawn sketches will not be accepted) of each electrical room, IT room, electrical equipment stand, generator area, or any other similar area with electrical equipment. Drawings shall indicate all panelboards, transformers, switchboards, generators, equipment racks, control panels, HVAC equipment, etc. that are located in each electrical/IT area. Layouts shall show that each piece of electrical equipment has the clearances, working space and dedicated equipment space required by applicable codes. No conduits to equipment within these areas shall be installed until submittals have been provided and returned without exception by the design team.

D. The contractor shall fully review, comment upon and correct all shop drawings as required to assure compliance with contract documents prior to submittal to Architect. The failure of the contractor to properly review and correct shop drawings prior to submittal will result in rejection of shop drawings by the engineer. Review by the Architect will be for general conformance with contract documents. The contractor shall be fully responsible for correctness of all submitted dimensions, details, quantities and locations.

E. None of the above items shall be installed until shop drawings or catalog data have been reviewed by Architect without rejection or required resubmittal. Any listed item not submitted, even if specified, shall be considered not acceptable and shall be removed if directed.

F. Any required resubmittal will be reviewed by the Architect for conformance with previously issued comments only. The contractor shall be responsible for verifying that all items not specifically requiring resubmittal have not been altered from the previously reviewed submittal.

G. Material proposed for substitution shall be of the same quality, perform the same functions, conform to such physical dimensions and appearance as are required by the Architect. All material proposed for substitution is subject to the approval of the Architect and his authority for approval is final. No material proposed for substitution will be considered unless all submittal data complies with the drawings and specifications of Section 16 as to time of submission, number of copies of submittal, and detail requirements.

H. Samples of material shall be furnished where required by drawings or Division 26/27/28 Specification, or as requested by the Architect on items proposed as substitutes.

I. Submit to Architect a certificate of final inspection from local inspection department.

PART 3 - EXECUTION

3.1 SITE VISIT

A. The Contractor shall visit the site to determine existing dimensions and conditions affecting electrical work. Failure to do so in no way relieves Contractor of his responsibility under Contract.

3.2 CLEARANCE WITH UTILITIES

A. It shall be the responsibility of this Contractor, prior to bid, to reaffirm with the utility companies involved, that the locations, arrangement (and with power company voltage, phase, and metering required) and connections to utility service are in accordance with their regulations and requirements. If their requirements are at variance with these drawings and specifications, the Contract price shall include any additional cost necessary to meet those requirements without extra cost to Owner after a contract is entered into.

B. On many projects the utility company may levy charges due to locations, size or type service involved. The Contractor shall be responsible for these charges (including permanent meter deposit), unless such charges are not available prior to bid and Contractor so documents as described below. The meter deposit will be refunded to the contractor at time of Owner's acceptance.

C. Should above cost not be available, prior to bid, Contractor must submit a letter signed by a responsible utility company person so stating with his bid and in turn must be submitted by Prime Contractor with his bid to Owner. The cost will then be deleted from the Contract and become responsibility of the Owner.

D. Arrange with utility companies for such services as shown or herein specified and installation of meter where shown. Furnish with shop drawings a signed document from utility companies describing the location and type of services to be furnished and any requirements they may have. This document shall be signed for each utility company by a person responsible for granting such service.

3.3 WORKMANSHIP

A. All work shall be in accordance with the latest editions of NFPA 70 (National Electrical Code), NFPA 101 (Life Safety Code), National Electric Safety Code, International Building Code, applicable NECA standards and the rules and regulations of State and Local Authorities Having Jurisdiction.

B. All work shall be executed in a workmanlike manner and shall present a neat and mechanical appearance upon completion.

C. All equipment, devices, etc. shall be installed in accordance with manufacturer's recommendations.

D. All items shall be installed straight and plumb in a workmanlike manner and care shall be exercised so that like items are mounted the same position, heights and general location.

E. Keep site clean of accumulation of cartons, trash and debris.

3.4 SAFETY

A. The contractor is solely responsible for all job safety. Architect assumes no responsibility for job safety. Maximum consideration shall be given to job safety and only such methods as will reasonably insure the safety of all persons shall be employed. The codes and regulations of OSHA shall be given strict compliance as well as such other codes, laws, and regulations as may be applicable.

3.5 CONTRACT DOCUMENTS

A. Contract documents indicate diagrammatically, extent, general character and approximate location of work. Where work is indicated but minor details omitted, furnish and install it complete so as to perform its intended functions. For details and mechanical equipment, follow drawings provided by other disciplines (Architectural, Mechanical, Structural, Civil, etc.) and fit electrical work thereto.

B. Contract documents consist only of the hardcopy documents issued by the Prime Architect. Electronic documents issued directly by the electrical engineer to the contractor and/or its sub-contractors/vendors are issued for convenience only (electronic documents are not formal contract documents).

C. If the contractor and/or one of its suppliers require a one-time transfer of electronic files of the current electrical construction documents to prepare shop drawings (or for another similar purpose), it shall:
1. Sign a waiver prepared by the electrical engineer prior to the transmittal of these files.
2. Agree to pay the electrical engineer a fee of $50.00 per drawing, up to a maximum of $400 per transfer, payable upon receipt of the files.
3. To the fullest extent permitted by law, indemnify, hold harmless, and defend JRA from all claims, damages, losses and expenses, including attorneys' fees arising out of or resulting from the use of the CAD files.

D. Take finish dimensions at job in preference to scaled dimensions.

E. Except as above noted, make no changes in or deviations from work as shown or specified except on written order of Architect.

3.6 UNDERGROUND UTILITY/EQUIPMENT COORDINATION

A. Prior to commencement of work, verify exact locations of all existing or proposed underground utilities and/or underground equipment and verify that proposed electrical installation does not conflict with these items. Notify Architect immediately if any conflict is found.

3.7 EQUIPMENT STORAGE

A. Store all electrical equipment in dry, covered locations as directed by equipment manufacturers. Contractor shall be responsible for replacing or repairing improperly-stored equipment as directed by Architect.

3.8 EXCAVATION, CUTTING AND PATCHING

A. Perform all cutting and excavating as necessary for installation of electrical systems, unless specifically covered under another section. After Architect's observation, complete all excavation, filling and backfilling as directed under specifications for preparation of site and earthwork. Foundations for equipment shall be as specified under concrete section. Concrete pads shall be minimum of 6" thick; unless greater thickness required by equipment manufacturer. Obtain specific approval of Architect before cutting into any structural members.

B. For all such work employ competent workmen, and finish up in neat and workmanlike manner, equal to quality and appearance to adjacent work.

3.9 PENETRATIONS

A. All penetrations in water tight barriers shall be made so that barrier rating is not compromised. Furnish roof flashing for all equipment installed under Division 26/27/28 that penetrates through the roof. Appropriate flashing is specified under roofing and sheet metal section. Supply these flashings for installation under roofing and sheet metal section.

B. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly to maintain the fire/smoke rating of the associated membrane.

C. Where penetrations are required through structural elements, verify penetration locations and sizes with structural engineer. In no case shall the structural integrity be compromised without written approval from structural engineer.

3.10 INSTALLATION OF EQUIPMENT - GENERAL

A. Care shall be exercised in exact routing and location of all items so as not to obstruct access to equipment, personnel walkways, or expose it to potential mechanical damage.

B. Items shall be securely anchored and/or fastened. Provide proper support for all equipment, devices, conduits, boxes, panels, etc. as required by code and for a workmanlike installation. Provide guy wiring for wood poles where required to prevent leaning. All construction shall meet the seismic design requirements of the building code. Items (especially transformers, light fixtures, equipment racks, freestanding gear, etc.) installed in seismic zones C, D, E or F shall be supported and braced per applicable codes and standards.

C. All wall, pole or frame-mounted electrical equipment shall be mounted to metal unistrut (or similar) frames of same material as electrical equipment. For example, pole-mounted painted or galvanized steel disconnect switches shall be mounted to galvanized steel unistrut frames.

D. All electrical equipment, furnished by Contractor or by others shall be covered and protected during construction.

E. All control cabinets, panels, motor control centers and other electrical cabinets and enclosures shall have all trash removed and be vacuumed clean. All foreign paint, etc., shall be removed from exterior and all scratches in finish touched up with same color and material as original. Any rusted areas shall be sanded, primed and repainted.

F. All relays, starters, push-button and other control devices shall be cleaned and if necessary, lubricated with CRC 2-26 to assure free operation.

3.11 MOTORS, STARTERS AND CONTROLS

A. Unless otherwise specified or shown, all motors will be furnished and installed under other sections of this specification.

B. Electrical Contractor shall install all starters and all electrical power wiring and connections to motors and starters.

C. Unless otherwise specified or shown, all control items for motors shall be furnished, installed and wired in conduit under other divisions of this specification.

3.12 CIRCUITS AND BRANCH CIRCUITS

A. Outlets shall be connected to branch circuits as indicated on drawings by circuit numbers. No more outlets than are indicated shall be connected to a circuit.

B. Branch circuit homeruns shall be installed as shown on drawings. Multiple homerun conduits shall not be combined by contractor into larger, single homerun conduits unless specific permission is granted by the Engineer.

3.13 LUG/TERMINAL RATINGS

A. All lug/terminal ratings, sizes, locations, types, etc. shall be coordinated with the associated conductor sizes, types, routings, etc. by the contractor.

B. All lugs/terminals/etc. shall be rated for 75 degree C terminations (minimum, unless specified otherwise).

3.14 EQUIPMENT FAULT CURRENT RATINGS

A. All equipment and breakers shall meet the minimum RMS symmetrical interrupting capacity ratings shown on plans for the associated distribution equipment. All interrupting ratings shall be full ratings. Where new devices or breakers are added to existing distribution equipment, the new devices/breakers shall have interrupting ratings matching or exceeding that of the existing distribution equipment.

3.15 OUTLET LOCATION

A. Symbols shown on drawings and mounting heights indicated on drawings and in specifications are approximate only. The exact locations and mounting height must be determined on the job and it shall be the Contractor's responsibility to coordinate with other trades to insure correct installation.

3.16 IDENTIFICATION

A. Each panel shall have each circuit identified. Panels without branch circuit nameplates shall have typewritten directories.

B. Each individually mounted switch, circuit breaker, starter and/or any other control or protective device shall identify equipment fed and fuse size, if any, by engraved plastic nameplate, white with black letters, screw attached.

C. See Specification Section 26 05 53 for additional requirements.

3.17 GROUNDING

A. All equipment shall be grounded and bonded in accordance with all state/local regulations, The National Electrical Code and as specified herein.

3.18 TELEPHONE WORK

A. Provide telephone raceways, outlets and backboards, as shown. Provide additional work as described in Specification Section 27 10 00 and/or shown on drawings. Bond all raceways together at backboards and provide No. 6 ground wire extending from raceway bonds to cold water pipe, in 1/2 inch raceway. Carefully ream ends of all raceways.

3.19 PAINTING

A. Refer to Painting/Finishing specifications for requirements regarding field painting of exposed conduit. Any scratches, dents or rust spots in conduit electrical enclosures, panels, motor control or any other electrical items shall have the dents removed, and they, along with any rust spots or scratches, sanded and touched up with the same exact color paint as original finish.

3.20 ACCEPTANCE TESTING

A. Upon completion of work, the entire electrical system installed within this project shall be tested and shall be shown to be in perfect working condition, in accordance with the intent of the specifications and drawings. It shall be the responsibility of the Electrical Contractor to have all systems ready for operation and to have an electrician available to operate same in accordance with and under the supervision of the observation representative(s) of the Architect. The Electrician shall be available to assist in removal of panel fronts, etc., to permit inspection as required.

B. The electrical sub-contractor shall include in bid price start-up assistance and training from a certified representative of the manufacturer for the following systems:
1. SECTION 26 09 43: LIGHTING CONTROL SYSTEM
2. SECTION 27 10 00: STRUCTURED CABLING SYSTEM
3. SECTION 28 20 00: CCTV SURVEILLANCE SYSTEM - IP
4. SECTION 28 31 00: FIRE ALARM SYSTEM
5. SECTION 28 78 00: EMERGENCY RESPONDER RADIO COVERAGE SYSTEM

3.21 OPERATION AND MAINTENANCE DATA

A. One set of marked “AS BUILT” drawings, three (3) sets of all equipment catalog and maintenance data and three (3) sets of all final shop drawings, on all equipment requiring same shall be turned over to owner. These items shall be bound in hard back book. Contractor shall explain and demonstrate all systems to Owner’s representative.

3.22 GUARANTY-WARRANTY

A. Furnish a written Guarantee-Warranty, countersigned and guaranteed by General Contractor, stating:
1. That all work executed under this section will be free from defects of workmanship and materials for a period of one (1) year from date of final acceptance of this work.
2. Above parties further agree that they will, at their own expense, repair and replace all such defective work, and all other work damaged thereby, which becomes defective during the term of the Guaranty-Warranty.

END OF SECTION 26 05 00

SECTION 26 05 19

POWER CONDUCTORS AND CABLES 51V-600V

PART 1 - GENERAL

1.1 DESCRIPTION

A. Power Wires and Cables

B. Low Voltage Wires and Cables

PART 2 - PRODUCTS

2.1 POWER WIRES AND CABLES - 600 VOLT

A. General: Conductors shall have current carrying capacities as per N.E.C. and with 600 volt insulation, #12 minimum except for controls and fixture wire. Conductors shall be copper.

B. General Application (see below for exceptions):
1. At or Below Grade (including within slab-on-grade):
   a. #8 or larger conductors:
      1) XHHW or RHH/RHW/USE stranded (in conduit).
   b. #10 or smaller conductors for circuits terminating at motors:
      1) THHN/THWN or XHHW stranded (in conduit).
   c. #10 or smaller conductors (excluding circuits terminating at motors):
      1) THHN/THWN or XHHW solid (in conduit).
2. Above Grade:
   a. #8 or larger conductors:
      1) THHN/THWN, XHHW or RHH/RHW/USE stranded (in conduit).
   b. #10 or smaller conductors for circuits terminating at motors:
      1) Where Exposed within Electrical Rooms OR Concealed in Wall/Ceiling Cavities (not concrete encased, etc.):
         a) THHN/THWN, XHHW or RHH/RHW/USE stranded (in conduit) or
         b) Metal-Clad (MC) cabling with THHN/THWN stranded conductors (conduit not required).
      2) Other Locations (where exposed outside electrical rooms or concrete encased): THHN/THWN, XHHW or RHH/RHW/USE stranded (in conduit).
   c. #10 or smaller conductors (excluding circuits terminating at motors):
      1) Where Exposed within Electrical Rooms OR Concealed in Wall/Ceiling Cavities (not concrete encased, etc.):
         a) THHN/THWN, XHHW or RHH/RHW/USE solid (in conduit) or
         b) Metal-Clad (MC) cabling with THHN/THWN solid conductors (conduit not required).
      2) Other Locations (where exposed outside electrical rooms or concrete encased): THHN/THWN, XHHW or RHH/RHW/USE solid (in conduit).
3. Metal-Clad (MC) cabling shall be rated for redundant grounding where installed in patient care areas per N.E.C. Article 517.
4. Power Wire and cable shall be as manufactured by Southwire, Rome, Encore Wire, American Insulated Wire, Okonite, Phelps-Dodge, Amercable, Aetna or approved equal.

C. Emergency Feeder Wiring
1. Where specifically required by NEC articles 700, 701, or other similar sections, feeder-circuit wiring for emergency systems and legally-required standby systems shall be a listed electrical circuit protective system consisting of 2-hour fire-rated, mineral insulated, copper-sheathed wiring cable (Pyrotenax System 1850 or equal).

D. Class 1 Control Cabling (120VAC Control Circuits, Etc.)
1. Unless specified otherwise, Class 1 control cabling shall:
   a. Be rated for exposed cable tray installation.
   b. Be plenum rated.
   c. Be UL-rated for the proposed application.
   d. Be multi-conductor with overall outer sheath as required by the application. The insulation of each conductor within the overall multi-conductor cable shall be uniquely color-coded. Ground conductors (when provided) within the multi-conductor cable shall have green insulation. Conductors with green insulation shall not be used for conductors other than ground.
   e. Utilize copper conductors.
   f. Have wire gauge as required to limit voltage drop to acceptable limits determined by the system supplier and to meet all applicable code requirements.
   g. Where installed underground, within slab-on-grade or in exterior locations, be rated for wet locations.
   h. Where required for specific systems, meet the specific requirements (conductor quantity, wire gauge, insulation type, shielding, etc.) of the system supplier.
   i. Be rated for 600V.
   j. Be industrial grade.
   k. Have stranded conductors.
   l. Have sunlight/oil-resistant PVC/Nylon insulation and jacket with ripcord.
2. Control cabling shall be as manufactured by Belden, AlphaWire or General Cable.

E. Fixture Wiring
1. Conductor Types:
   a. Type TFFN or XFF.
2. Minimum Sizes:
   a. For fixtures up to 300 watts: #16.
   b. For fixtures over 300 watts up to 1500 watts: #14.
   c. For fixtures over 1500 watts: as required.
   d. Conductors to concrete pour fixtures: #12.
3. Fixture wire shall extend only from fixture to first junction, and not over 6 feet, except for concrete pour units.

2.2 WIRE CONNECTIONS:

A. All connector types:
1. Shall be properly rated for the proposed application by UL and per the manufacturer.

B. At Motor Connections (within motor terminal boxes):
1. On Unshielded Wire:
   a. Single conductor per phase: shall be made with insulated set screw connectors or 3M 5300 Series 1kV Motor Lead Connections kits with mechanical lugs as required.

b. Multiple conductors per phase: shall be made with insulated mechanical lugs, rated for the associated motor cable types, by Polaris or Ilsco.

2. On Shielded Power Wire:
   a. The braided shields and internal grounding conductors of shielded power (not instrumentation) cables shall be grounded at BOTH ends (at VFD/starter and at motor) with a termination kit provided by the cable supplier. This termination kit shall include a connection ring that makes contact around the full circumference of the braided shield, and connects all internal grounds to a common external ground point.

C. Other Dry locations:
1. On Wire larger than #10: shall be made with solderless, non-insulated compression-type connectors meeting requirements of Federal Specification WS-610e for Type II, Class 2 and shall be covered with Scotch #33 electrical tape so that insulation is equal to 150% of conductor insulation.
2. On Wire #10 and smaller: shall be made with one of the following:
   a. Ideal Wing Nuts or equal by 3M .
   b. Ideal Push-In Wire Connectors (for #12 and smaller only).

D. Other Wet/Damp locations:
1. On Wire larger than #10: shall be made with underground/direct-burial, waterproof rated EPDM or TPE-insulated connectors by Ilsco, Burndy or T&B.
2. On Wire #10 and smaller: shall be made with one of the following:
   a. Ideal Weatherproof or Underground Wire Connectors pre-filled with 100% silicone sealant as required by the application.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. All wires and cables shall be installed in conduit unless specifically noted otherwise.

B. Metal-clad (MC) cabling (not required to be installed within conduit) may be used for above-grade, concealed branch circuits where allowed by code. MC cable installation shall:
1. NOT be installed exposed except in electrical rooms.
2. be provided with dedicated neutrals for all multi-wire circuits. Conductors shall be color coded as described below.
3. be run orthogonal with the building structure.
4. be supported per N.E.C. requirements. At a minimum MC cabling shall be supported on six foot intervals and within 12” of all outlet/junction boxes.
5. be supported independently from the building structure and shall not come into contact with other building systems (ductwork, piping, conduits, etc.).
6. be rated for redundant grounding where installed in patient care areas per N.E.C. Article 517.

C. All joints and splices on wire shall be made with solderless connectors, and covered so that insulation is equal to conductor insulation.

D. No splices shall be pulled into conduit.

E. No conductor shall be pulled until conduit is cleaned of all foreign matter.

F. Wire and cable shall be neatly formed, bundled and tied in all panelboards, wireways, disconnect switches, pullboxes, junction boxes, cabinets and other similar electrical enclosures.

G. All wires and cables installed in underground or other wet locations shall be rated by the manufacturer for wet locations.

H. Network cabling shall be continuous from endpoint to endpoint and shall not be spliced unless specifically noted otherwise.

I. All conductors/cabling (including spare conductors) shall be properly terminated unless specifically directed otherwise. See above for general termination hardware requirements.

3.2 POWER WIRE AND CABLE INSTALLATION:

A. No power conductor shall be smaller than #12 except where so designated on the drawings or hereinafter specified.

B. Multi-wire lighting branches shall be used as indicated.

C. Where more than three current-carrying conductors are installed in a single raceway or cable, conductors shall be derated as indicated in NEC Table 310.15(B)(3)(a).

D. Raceways/cables shall generally not be installed exposed to sunlight on roofs unless specifically required. Where raceways or cables are installed exposed to sunlight on roofs, conductors shall be derated with ampacities adjusted per NEC Table 310.15(B)(3)(c).

E. In installing parallel power conductors, it is mandatory that all conductors making up the feeder be exactly the same length, the same size, the same type of conductor with the same insulation. Each group of conductors making up a phase or neutral must be bonded at both ends in an approved manner.

F. In installing overhead main power services, a minimum of 5’-0” of cable per run shall be extended beyond the weatherhead(s) for connection to service drop. Confirm exact requirements with local utility company.

3.3 WIRE CONNECTIONS

A. See Part 2 above for material types.

B. Aluminum Wire Connections:
1. Where aluminum wiring is allowed, connections shall utilize compression fittings, no exceptions (Anderson Versa Crimp or equal).

C. Any stranded wire connection to wiring devices shall be made with crimp type terminals.

D. All electrical connections and terminals shall be tightened according to manufacturer’s published torque-tightening values with calibrated torque wrenches as required to clearly indicate final torque value to the contractor. Where manufacturer’s torque values are not provided, those specified in UL 486A & 486B shall be used.

E. All connections and connector types shall be installed in strict compliance with all requirements

of the connector manufacturer.

F. Under no condition shall the specified conductors be connected to terminals rated less than 75°C. Where conductors sized #1 or smaller are shown to be terminated at equipment and the terminals of that equipment are rated for less than 75°C, contractor shall install junction box near equipment to capture the specified conductors, splice with compression connections (rated for a least 75°C) and extend conductors with ampacity rating as required by NEC (based on terminal temperature rating) to equipment terminals. The length of the conductors to be terminated shall be as directed by the AHJ but not less than 48 inches.

3.4 LOW VOLTAGE (LESS THAN 50V) CONTROL AND NETWORK CABLE INSTALLATION:

A. All wires and cables shall be installed in conduit unless specifically noted otherwise. Low voltage control and/or network cabling located within concealed, accessible ceiling spaces (such as above lay-in ceilings) may be run without conduit if the following requirements are met:
1. Cabling shall be plenum-rated, multi-conductor.
2. Cabling shall be supported by cable tray or with J-hook supports on intervals not to exceed 5'-0" on center. Cabling shall be supported solely from the cable tray or j-hooks supported from the building structure, without using piping, ductwork, conduit or other items as supports.
3. Cabling shall be properly bundled with plenum-rated Velcro straps on intervals not to exceed 30" on center.
4. Properly-sized conduit(s) shall be provided wherever cabling enters an inaccessible or exposed area (such as above gyp board ceilings or through walls). End bushings shall be provided on both ends of all raceway terminations. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly.

3.5 CIRCUITS AND BRANCH CIRCUITS

A. Outlets shall be connected to branch circuits as indicated on drawings by circuit number adjacent to outlet symbols, and no more outlets than are indicated shall be connected to a circuit.

3.6 LABELING AND COLOR CODING OF WIRE AND CABLE

A. Refer to Specification Section 26 05 53 for all labeling requirements.

B. A color coding system as listed below shall be followed throughout the network of branch power circuits as follows:

PHASE	120/208/240/ COLOR	120/240 HIGH LEG DELTA COLOR	277/480 VOLT COLOR
A	BLACK	BLACK	BROWN
B	RED	ORANGE (FOR HI-LEG)	ORANGE
C	BLUE	BLUE	YELLOW
NEUTRAL	WHITE	WHITE	GRAY
GROUND	GREEN	GREEN	GREEN

C. Where dedicated neutrals are installed for multi-wire branch circuits, the neutral conductors shall be color coded as follows:

PHASE	120/208/240/ COLOR	120/240 HIGH LEG DELTA COLOR	277/480 VOLT COLOR
NEUTRAL A	WHITE W/ BLACK TRACER	WHITE W/ BLACK TRACER	GRAY W/ BROWN TRACER
NEUTRAL B	WHITE W/ RED TRACER	WHITE W/ ORANGE TRACER (FOR HI-LEG NEUTRAL)	GRAY W/ ORANGE TRACER
NEUTRAL C	WHITE W/ BLUE TRACER	WHITE W/ BLUE TRACER	GRAY W/ YELLOW TRACER

D. Control Conductors: Shall be color coded by use of colored "tracers". No control circuit shall contain two identical conductors. For example, a set of five (5) control conductors for a pushbutton station represents one (1) control circuit which would require five (5) uniquely-colored control conductors.

3.7 TESTING

A. The insulation resistance of all feeder conductors (feeding electrical distribution equipment such as switchboards, panelboards, transfer switches, transformers, etc.) shall be tested at the load side of the feeder breaker with a 1000-volt DC Megger Tester prior to energization or final termination. Any feeder conductor with an insulation resistance less than the recommended minimums in the latest version of NETA Acceptance Testing Specification ("ATS") standard shall be replaced by the contractor at the contractor's expense. All final test results shall be clearly documented (with date, time, feeder, results, test equipment, etc.), and the final test results shall be submitted to the design team for review.

END OF SECTION 26 05 19

SECTION 26 05 26

GROUNDING

PART 1 - GENERAL

1.1 GENERAL

A. THE WORK UNDER THIS SECTION INCLUDES BUT IS NOT LIMITED TO GROUNDING OF THE FOLLOWING:
1. Service Equipment.
2. Transformers.
3. Non-current carrying conductive surfaces of equipment.
4. Metal Buildings.
5. Structures.
6. Other Equipment.

1.2 GENERAL REQUIREMENTS

A. All equipment, building steel, and main service shall be effectively and permanently grounded with a conductor cross section as required by the National Electrical Code and of capacity sufficient to insure continued effectiveness of the ground connections for fault current. Ground conductors shall be as short and straight as possible, protected from mechanical injury and, if practicable, without splice or joint.

B. All grounding connections shall be installed in accordance with the National Electrical Code and all local codes and requirements. Such codes shall be considered minimum requirements and the installation of the grounding system shall insure freedom from dangerous shock voltage exposure and provide a low impedance ground fault path to permit proper operation of overcurrent and ground fault protective devices.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. All grounding conductors shall be insulated with green colored, 600 volt insulation unless noted otherwise.

B. Motors having power supplied by single conductor wire in conduit shall be grounded through the conduit system. Flexible conduit shall be “jumpered” by an appropriate bonding conductor.

2.2 GROUNDING ELECTRODES

A. Grounding electrodes shall be copper-clad steel rods 3/4 inch in diameter and ten feet long. Where longer electrodes are necessary to reduce the ground resistance, Contractor shall provide sectional rods, connectors, drive heads, etc.

2.3 CONNECTIONS

A. All conductor-to-conductor, conductor-to-ground rod, conductor-to-structure, conductor-to-fence connections of #6 and larger sized conductors and underground ground connections shall

be permanent exothermic welded connections (Cadweld or equal) unless otherwise noted on applicable drawings.

B. Connections to equipment shall be by bolted compression type lugs (except for motors). When the conductor is #6 and larger, the lug shall be joined to the conductor by an exothermic weld (Cadweld or equal).

C. Motors to be grounded by the grounding conductors run with the power conductors shall have a split-post grounding stud installed in the connection box.

D. Each cast pull box or junction box shall have a ground lug, connected to largest ground conductor to enter box.

E. Ground connections at conduit terminations shall be made by approved grounding bushings (see Raceways Specification Section for additional requirements).

2.4 MANUFACTURERS

A. Conduit clamps and connectors shall be manufactured by Raco, OZ., or Ercon.

B. Lugs shall be as manufactured by Square “D”, Burndy, or T and B.

C. Exothermic weld connections shall be as manufactured by Cadweld, or approved equal.

D. Ground rods shall be as manufactured by Joslyn or McGraw Edison.

E. Split post grounding shall be as manufactured by Burndy or T and B.

PART 3 - EXECUTION

3.1 MAIN SERVICE GROUND

A. The main service grounding electrode system shall consist of the following items bonded together by the grounding electrode conductor:
1. The main underground cold water pipe (metal).
2. The metal frame of the building.
3. Driven ground rods. Ground rods shall be embedded at the lowest point in the building and below the permanent moisture level. Ground rods shall be spaced a minimum of ten (10) feet apart and connected in parallel until resistance to ground does not exceed five (5) ohms.

B. The grounding electrode system shall be connected to the grounded conductor (neutral) on the supply side of the service disconnecting means by a grounding electrode conductor not smaller than that shown in Table 250.66 of the N.E.C. The main service equipment grounding conductor shall be connected to the grounding conductor on the supply side of the service disconnecting means in accordance with Table 250.122 of the N.E.C. for the ampere rating of the service entrance equipment. Where in a service entrance switchboard, the equipment grounding conductor shall not be less than 25% of the main bus rating. These connections shall be made inside the service entrance equipment enclosure.

3.2 TRANSFORMER GROUNDS

A. Dry type insulation transformers with a grounded conductor in the secondary shall be grounded in accordance with N.E.C. Section 250-30.

3.3 EXPOSED NON-CURRENT-CARRYING METAL PARTS

A. General: Ground connections to equipment or devices shall be made as close to the current carrying parts as possible, that is, to the main frame rather than supporting structures, bases or shields. Grounding connections shall be made only to dry surfaces that are clean and dry. Steel surfaces shall be ground or filed to remove all scales, rust, grease, and dirt. Copper and galvanized steel shall be cleaned to remove oxide before making welds or connections. Code size ground conductors shall be run in all power conduits and properly terminated at each end.

B. Ground conductors shall be routed as straight as possible. Where possible, ground conductors shall be routed such as to avoid bends exceeding 90 degrees or with a radius of less than 8".

C. Motors: Exposed non-current-carrying metal parts, shall be grounded by a grounding conductor either run with power conductors, and/or separate grounding conductors. Drawings will show method(s) to be used. The ground conductors with all motor conductors shall be connected to the ground buss in the motor connection box. Jumper connections shall be installed between frames and rigid conduit for equipment having flexible conduit connections (sealtight). All AC motor grounds shall provide a low impedance path to ground.

D. Raceways & boxes: All raceways, conduits, armored or shielded cable and all exposed non-current carrying metal parts shall be grounded. Such items shall be bonded together and permanently grounded to the equipment ground buss. Metallic conduits shall be connected by grounding or clamps to ground buss. Flexible "jumpers" shall be provided around all raceway expansion joints. Bonding straps for steel conduit shall be copper. Jumper connections shall be provided to effectively ground all sections or rigid conduit connected into plastic pipe. No metallic conduit shall be left ungrounded. In conduit systems interrupted by junction or switch boxes where locknuts and bushings are used to secure the conduit in the box, the sections of conduit and box must be bonded together. If conduit, couplings or fittings have a protective coating or non-conductive material, such as enamel, such coating must be thoroughly removed from threads of both couplings and conduit and the surface of conduit or fitting where the ground clamp is secured.

E. Enclosures: Metal conduits entering free standing motor control centers, switchboards or other free standing equipment shall be grounded by bare conductors and approved clamp. Any conduits entering low voltage (480 volts or below) equipment through sheet metal enclosure and effectively grounded to enclosure by double locknut or hub need not be otherwise bonded.

F. Equipment: In addition to equipment grounding provisions mandated by code requirements, additional equipment grounding provisions (including local ground rods, connections, etc.) shall be provided by the contractor as directed by equipment suppliers.

G. Both ends of ground busses in motor control centers, switchboards, etc., shall be separately connected to the main ground buss to form two separate paths to ground.

H. Fences and Grills: Fences and metal grills around equipment carrying voltage above 500 volts between phases shall be bonded together and to ground. Fences and grill work shall be grounded at every post, column, or support, and on each side of every gate.

3.4 ACCEPTANCE DOCUMENTATION AND TESTING

A. Contractor shall take and store photographs of all underground grounding system connections prior to burial of connections, for review by Engineer.

B. Upon completion of work, the entire ground system shall be shown to be in perfect working condition, in accordance with the intent of the Specifications.

C. Contractor shall measure the resistance between the main ground bonding jumper to true earth ground using the Fall of Potential method as described by ANSI/IEEE Standard 81 ("Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of an Earth System"). If the measured value is greater than five ohms, additional grounding electrodes shall be installed as described in Part 3.1 above. The final ground resistance value shall be submitted in writing, and documented via picture of the meter reading from the Fall of Potential test, to the Architect prior to the final observation, and shall be included in final O&M documentation.

END OF SECTION 26 05 26

SECTION 26 05 33

RACEWAYS

PART 1 - GENERAL

1.1 DESCRIPTION

A. THE WORK UNDER THIS SECTION INCLUDES BUT IS NOT LIMITED TO THE FOLLOWING:
1. Conduits
2. Conduit Fittings
3. Couplings & Connectors
4. Bushings
5. Raceway Hardware, Conduit Clamps & Supports
6. Watertight Entrance Seal Devices

PART 2 - PRODUCTS

2.1 CONDUITS

A. Rigid Galvanized Steel and I.M.C.:
1. Shall be galvanized outside and inside by hot dipping.
2. Shall be as manufactured by Republic, Wheatland, Triangle, Pittsburg Standard, Youngstown, Allied or equal.

B. E.M.T.:
1. Shall be Electro-Galvanized.
2. Shall be as manufactured by Republic, Wheatland, Triangle, Pittsburg Standard, Youngstown, Allied or equal.

C. Rigid Aluminum:
1. Shall be manufactured of 6063 Alloy, T-1 temper.
2. Shall be as manufactured by Republic, Wheatland, Triangle, Pittsburg Standard, Youngstown, Allied or equal.

D. Schedule 40 and 80 PVC:
1. Shall be composed of polyvinyl chloride and shall be U.L. rated type 40 or 80 for use with 90 degree rated conductors. Conduit shall conform to NEMA Standards and applicable sections of N.E.C.
2. The conduit manufacturer shall have had a minimum of 5 years experience in the manufacture of the products. Non-metallic raceways shall be as manufactured by Carlon, Triangle, Can-Tex, Allied or equal.

E. HDPE Innerduct
1. Shall be composed high density polyethylene and shall be orange in color, unless noted otherwise.
2. Shall be corrugated unless noted otherwise.
3. Shall be manufactured by Carlon, Ipex or equal.

F. Flexible Metallic Conduit:
1. Shall be continuous spiral wound and interlocked galvanized material, code approved for grounding.

G. Liquidtight Flexible Metallic Conduit:
1. Shall be galvanized steel-core sealtite, code approved for grounding.
2. Shall have an outer liquidtight, nonmetallic, sunlight-resistant jacket over an inner flexible metal core.
3. Shall be as manufactured by Electric-Flex, Anaconda or equal.

2.2 FITTINGS, COUPLINGS & CONNECTORS

A. Rigid Galvanized Steel and I.M.C. couplings and connectors shall be standard threaded type, galvanized outside and inside by hot dipping. Threadless and clamp type are not acceptable. Couplings/connectors shall be as manufactured by Raco, Efcor, or Appleton or equal.

B. All rain tight connectors shall be threaded Myers or approved equal, rated for outdoor application.

C. E.M.T. couplings and connectors shall be set screw, or steel compression type. All couplings and connectors shall be 720B, 730, 750B, or 760 series of Efcor or equal series of Raco. Pressure indented type connectors or cast metal will not be approved for any location. E.M.T. couplings and connectors shall be as manufactured by O-Z/Gedney, T&B, Efcor, Raco, Midwest or equal. E.M.T. fittings, couplings and connectors located within concrete (where allowed) shall be compression type and shall be adequately sealed with tape to ensure a concrete-tight seal.

D. Rigid Aluminum couplings and connectors shall be standard threaded type, of the same alloy as the associated conduit. Threadless and clamp type are not acceptable. Fittings shall be as manufactured by Thomas & Betts, Crouse-Hinds, Appleton, Pyle-National or equal.

E. All PVC couplings, adapters, end bells, reducers, etc., shall be of same material as conduit.

F. Liquidtight Flexible Metallic Conduit connectors shall be liquidtight with insulating throat or end bushing, designed for application with Liquidtight Flexible Metallic Conduit. Fittings shall be as manufactured by Efcor, Raco, Midwest or equal.

G. All LB unilets sizes 1 ¼” or larger shall have rollers.

H. Miscellaneous conduit fittings shall be as manufactured by Appleton, Crouse-Hinds, Pyle-National, Russell & Stoll or equal.

2.3 BUSHINGS

A. All non-grounding rigid bushings 1-1/4” and larger shall be the insulating type (O-Z/Gedney type “BB” or equal by T&B, Midwest Electric or Penn Union).

B. All non-grounding rigid bushings 1” and smaller shall be threaded malleable iron with integral noncombustible insulator rated for 150°C. Non-grounding rigid conduit bushings shall be O-Z/Gedney type “B” or equal by T&B, Midwest Electric or Penn Union.

C. All grounding rigid bushings shall be threaded malleable iron with integral noncombustible insulator rated for 150°C. All grounding rigid conduit bushings shall be O-Z/Gedney type "BLG" or equal by T&B, Midwest Electric or Penn Union.

2.4 HARDWARE, CONDUIT CLAMPS AND SUPPORTS

A. All hardware such as expansion shields, machine screws, toggle bolts, "U" or "J" bolts, machine bolts, conduit clamps and supports shall be of corrosion resistant materials (stainless steel, aluminum, galvanized or plated steel, or other approved materials).

B. Hardware in contact with aluminum handrails, plates or structural members and all hardware in exterior, wet or corrosive areas shall be type 316 stainless steel or aluminum (with bitumastic paint coating to isolate aluminum from contact with concrete where necessary) unless specifically noted otherwise.

C. Supports in exterior, wet or corrosive locations shall be type 316 stainless steel or aluminum (with bitumastic paint coating to isolate aluminum from contact with concrete where necessary) unless specifically noted otherwise.

D. Supports in extremely corrosive environments (such as chlorine or fluoride storage rooms) shall be PVC-Coated steel unless specifically noted otherwise.

E. Hardware and conduit clamps shall be as manufactured by Efcor, Steel City, G.A., Tinnerman or equal.

2.5 WATERTIGHT ENTRANCE SEAL DEVICES

A. For new construction, seal devices shall consist of oversized sleeve and malleable iron body with sealing rings, pressure rings, sealing grommets and pressure clamps as required (O-Z/Gedney type FSK/WSK or equal).

B. For cored-hole applications, seal devices shall consist of assembled dual pressure disks with neoprene sealing rings and membrane clamps as required (O-Z/Gedney type CSM or equal).

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Minimum Diameter: 1/2-inch.

B. Raceway Type: Raceway types shall be as specified below, unless indicated otherwise on drawings:
   1. Exterior, Exposed: Rigid Galvanized Steel or I.M.C. unless otherwise noted.
   2. Other Exterior (Concrete-Encased or Direct Earth Buried): Schedule 40 PVC. PVC conduit shall convert to metallic conduit prior to exiting concrete-encasement or direct earth burial. See "transition" items below for additional requirements. Conduits shall be left exposed until after Architect's observation.
   3. Interior, Exposed:
      a. Hazardous Locations: Rigid Galvanized Steel .
      b. Wet Locations (including, but not limited to, Pump Rooms, Wet Wells, Underground Vaults, and other similar locations): Rigid Galvanized Steel or I.M.C. .

c. Dry Locations Where Subject to Mechanical Damage (including, but not limited to, below 10'-0" A.F.F. in shop, storage, warehouse and other similar areas): Rigid Galvanized Steel or I.M.C..
d. Extremely Corrosive Locations (Chlorine Storage Rooms, Fluoride Storage Rooms and other similar areas): Schedule 80 PVC.
e. Other Dry Locations: E.M.T.

4. Interior, Concealed:
   a. Embedded inside Poured Concrete Walls, Ceilings or Floors, with a minimum of 2" of concrete between finished surface and outer wall of conduit on all sides, where no anchor bolts, screws or other similar items will be installed: Schedule 40 PVC. PVC conduit shall convert to metallic conduit (exact type as specified elsewhere within this section) prior to exiting poured concrete-encasement of wall, ceiling, floor or ductbank. See "transition" items below for additional requirements.
   b. Other Raceways Embedded inside Poured Concrete Walls, Ceilings or Floors (not meeting requirements above): Rigid Galvanized Steel or I.M.C. (coated with two (2) spiral-wrapped layers of 3M Scotchrap 50 PVC tape or two coats of asphaltum paint where below grade or within concrete).
   c. Other Raceways: E.M.T.
5. Terminations at motors, transformers and other equipment which has moving or vibrating parts:
   a. Exterior or Wet Locations (including, but not limited to, Pump Rooms, Wet Wells, Underground Vaults, and other similar locations): Liquidtight Flexible Metallic Conduit (shall generally not exceed 24 inches in length) with watertight fittings.
   b. Dry, Interior Locations: Flexible Metallic Conduit (shall generally not exceed 24 inches in length).
6. Terminations at fixtures mounted in grid-type ceilings:
   a. Flexible Metallic Conduit or MC cabling (shall generally not exceed 72 inches in length and shall run from junction box to fixture, not from fixture to fixture).
7. Transition from underground or concrete-encased to exposed:
   a. Convert PVC to Rigid Galvanized Steel (coated with two (2) spiral-wrapped layers of 3M Scotchrap 50 PVC tape or two coats of asphaltum paint where below grade or within concrete) utilizing Rigid Galvanized Steel 90 degree bends (and vertical conduits as required by application) prior to exiting concrete/grade (except at outdoor pull boxes and under freestanding electrical equipment, where terminations shall be by PVC end bells installed flush with top of slab). Exposed portions of these coated conduits shall extend a minimum of 6" above floor level, and shall be installed at uniform heights.

3.2 RACEWAY INSTALLATION

A. General:
1. Follow methods which are appropriate and approved for the location and conditions involved. Where not otherwise shown, specified, or approved in a particular case, run all wiring concealed.
2. Where conduit crosses a structural expansion joint an approved conduit expansion fitting shall be installed.
3. A non-conductive polypropylene pull string, properly tied/secured at either end, shall be installed in all empty conduits.
4. Metal conduit field-cuts shall be cut square with a hacksaw and the ends reamed after threading.
5. PVC conduit field-cuts shall be made with hacksaw, and ends shall be deburred.

6. All PVC joints shall be made as follows:
   a. Clean the outside of the conduit to depth of the socket, and the inside of socket with an approved cleaner.
   b. Apply solvent cement as recommended by the conduit manufacturer to the interior of the socket and exterior of conduit, making sure to coat all surfaces to be joined.
   c. Insert conduit into the socket and rotate 1/4 to 1/2 turn and allow to dry.
7. All metallic conduit installed below grade or within concrete shall be coated with two (2) spiral-wrapped layers of 3M Scotchrap 50 PVC tape or two coats of asphaltum paint prior to installation.
8. Install ground wire sized per N.E.C. Table 250.122 in all conduits.
9. Use of running threads is absolutely prohibited. Conduit shall be jointed with approved threaded conduit couplings. Threadless and clamp type not acceptable.
10. Conduits shall be sized in accordance with latest National Electrical Code except when size shown on drawings. 1/2-inch conduit shall not contain conductors larger than No. 12 or more than four (4) No. 12 conductors.
11. Exposed, field-cut threads on all metal conduits shall be painted with zinc primer (for Galvanized Rigid or I.M.C.) .

B. Routing/Locating:
1. Exposed conduit runs shall be run level and plumb and shall, on interior of buildings, be run parallel and/or at right angles to building walls and/or partitions.
2. Conduit with an external diameter larger than 1/3 the thickness of a concrete slab shall not be placed in the slab. Conduits in slab shall not be spaced closer than 3 diameters on center.
3. Conduit run in ceiling spaces shall be run as high as possible, all at same level, and shall be supported from building structure. Do not support conduit from any other installation.
4. Conduit run within exterior CMU, concrete or other similar walls shall be run within the CMU cells / concrete structure / etc. Conduits shall not be run on the outside surface of CMU cells / concrete structure / etc. underneath exterior veneers / etc., which could cause a thermal break in the wall insulation or a future water intrusion problem.
5. Install conduit runs to avoid proximity to steam or hot water pipes. In no place shall a conduit be run within 6” of such pipes except where crossing is unavoidable, then conduit shall be kept at least 3” from the covering of the pipe crossed.
6. Before installing raceways for motors, HVAC equipment and other fixed equipment, check location of all equipment connections/terminal boxes with equipment supplier and locate and arrange raceways appropriately.
7. A minimum of 12” of clearance (or more as required by associated utility companies) shall be provided between the finished lines of exterior, underground conduit runs and exterior, underground utilities (gas, water, sewer, etc.).
8. Where any portion of raceway is installed in a wet environment (such as below grade) and located at a higher elevation than the raceway termination point in a dry environment, install watertight compound inside raceway at termination around cabling to prevent transfer of water through conduit system. Watertight compound shall be rated for the potential water head pressure, based on the assumption that ground water level would be at grade level.

C. Bends:
1. Do not make bends (in any raceway, including flexible conduits) that exceed allowable conductor bending radius of cable to be installed or that significantly restrict conductor flexibility.

2. All bends within concrete-encased ductbanks installed in exterior locations shall be long radius bends (24" minimum bending radius – varies with conduit diameter).
3. Where numerous exposed bends or grouped together, all bends shall be parallel, with same center and shall be similar in appearance
4. All PVC elbows, bends, etc., shall be either factory bends or made with an approved heat bender.

D. Support:
1. Anchor conduit securely in place by means of approved conduit clamps, hangers, supports and fastenings. Arrangement and methods of fastening all conduits shall be subject to Engineer's direction and approval. All conduits shall be rigidly supported (wire supports may not be used in any location). Use only approved clamps on exposed conduit.
2. Conduit in riser shafts shall be supported at each floor level by approved clamp hangers.
3. Right angle beam clamps and U bolts shall be specially formed and sized to snugly fit the outside diameters of conduits.
4. Where installed in seismic zones, suspended raceways shall be braced in two (2) directions as required to prevent swaying and excessive movement.
5. Raceways installed on top of flat roofing shall be supported a minimum of 3 ½" above roof with rubber block supports (Cooper B-Line Dura-Blok or equal). Installation shall be in strict accordance with support manufacturer's instructions and recommendations.

E. Terminations:
1. All conduit connections to sheet metal cabinets or enclosures located in exterior or wet locations shall terminate by use of rain tight (Meyers) hubs.
2. Where rigid or I.M.C. conduits enter sheet metal boxes, they shall be secured by approved lock nuts and bushings.
3. Where metal conduits enter outdoor pull boxes, manholes, under freestanding electrical equipment or other locations where direct metal-to-metal contact does not exist between enclosure and conduit, grounding bushings shall be installed. Each grounding bushing shall be connected to the enclosure ground and all other grounding bushings with properly sized grounding conductors.
4. Where E.M.T. enters sheet metal boxes they shall be secured in place with approved insulating fittings.
5. Where PVC enters outdoor pull boxes, manholes or under freestanding electrical equipment, PVC end bells shall be installed.
6. Contractor shall be responsible for coordinating required conduit sizes with equipment hubs/conduit entry provisions (such as at motor tap boxes) prior to installation of conduit systems. Contractor shall field adjust final conduit sizes at terminations where so required (only as allowed by code) from those indicated on plans to coordinate with equipment hubs/conduit entry provisions.
7. Where conduit terminates in free air such that associated cabling/circuitry becomes exposed (such as at cable trays, etc.), conduit shall generally terminate in a horizontal orientation (to prevent dust/debris/etc. from entering conduit system). Where vertical conduit termination is necessary, the termination shall be provided with cord-grip conduit terminations to seal the conduit system.
8. Conduit ends shall be carefully plugged during construction.
9. Permanent, removable caps or plugs shall be installed on each end of all empty raceways with fittings listed to prevent water and other foreign matter from entering the conduit system.

F. Penetrations:
1. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly. Refer to drawings and other specifications for additional requirements.
2. All penetrations shall be at right angles unless shown otherwise.
3. Structural members (including footings and beams) shall not be notched or penetrated for the installation of electrical raceways unless noted otherwise without specific approval of the structural engineer.
4. Dry-packed non-shrink grout or watertight seal devices shall be used to seal openings around conduits at all penetrations through concrete walls, ceilings or aboveground floors.
5. All raceways entering structures, or where water is otherwise capable of entering equipment/devices through the raceway system, shall be sealed (at the first box or outlet) with foam duct sealant to prevent the entrance of gases or liquids from one area to another or into equipment/devices.
   a. Where the elevation of the raceway penetration (into the structure) is no more than 15' below the other (higher) end of the same raceway, Polywater FST sealant (rated to hold back up to 22' of continuous water head pressure), or pre-approved equal, shall be used.
   b. Where the elevation of the raceway penetration (into the structure) is between 15' and 75' below the other (higher) end of the same raceway, Polywater PHRD Custom Mechanical Seals (rated to hold back up to 36psi or 83' of continuous water head pressure), or pre-approved equal, shall be used.
   c. Where the elevation of the raceway penetration (into the structure) is more than 75' below the other (higher) end of the same raceway, the contractor shall propose a custom solution designed to hold back or to drain the possible water within the associated raceway. Submittals shall be provided to the engineer for review/approval, including a summary of the anticipated elevations/PSIs, details of the proposed installation, cut-sheets of devices/materials, etc.
6. Additionally, where necessary to ensure that water does not enter equipment/devices through the raceway system (where raceways extend to equipment/devices from wet areas), junction boxes with drain assemblies in bottom shall be located at low point of raceway system near equipment/devices (to drain water out of raceway system before it enters equipment/devices). Contractors shall provide drains in raceway systems where so necessary to prevent water entry into equipment/devices.
7. All raceways passing through concrete roofs or membrane-waterproofed walls or floors shall be provided with watertight seals as follows:
   a. Where ducts are concrete encased on one side: Install watertight entrance seal device on the accessible side of roof/wall/floor as directed by equipment manufacturer.
   b. Where ducts are accessible on both sides: Install watertight entrance seal device on each side of roof/wall/floor as directed by equipment manufacturer.
8. All raceways passing through walls of rooms containing/storing noxious chemicals (chlorine, ammonia, etc.) or through hazardous locations shall be sealed with conduit seals (Crouse-Hinds type EYS or equal).
9. All raceways terminating into electrical enclosures/devices/panels/etc. located in hazardous locations shall be sealed with conduit seals (Crouse-Hinds type EYS, EZS or equal) within 18" of the termination.

G. Exterior Electrical Ductbanks:
1. Where exterior electrical concrete-encased ductbanks are indicated on drawings, conduit runs between buildings or structures shall be grouped in concrete-encased ductbanks as follows:

a. A minimum of 3" of concrete shall encase each side of all ductbanks.
b. A minimum of 1 ½" of separation shall be provided between each conduit within ductbanks. PVC spacers shall be installed at the necessary intervals prior to placement of concrete to maintain the required spacing and to prevent bending or displacement of the conduits.
c. Top of concrete shall be a minimum of 30" below grade. A continuous magnetic marking tape shall be buried directly above each ductbank, 12" below grade.
d. Exact routing of ductbanks shall be field verified and shall be modified as necessary to avoid obstruction or conflicts.
e. Underground electrical raceways shall be installed to meet the minimum cover requirements listed in NEC Table 300.5. Refer to drawings for more stringent requirements.

END OF SECTION 26 05 33

SECTION 26 05 34

OUTLET BOXES, JUNCTION BOXES, WIREWAYS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Outlet and Junction Boxes

B. Pull Boxes

C. Wireways

PART 2 - PRODUCTS

2.1 OUTLET BOXES & JUNCTION BOXES (THROUGH 4-11/16")

A. Sheet Metal: Shall be standard type with knockouts made of hot dipped galvanized steel as manufactured by Steel City, Raco, Appleton, Bowers or equal.

B. Cast: Shall be type FS, FD, JB, GS, or SEH as required for application as manufactured by O-Z/Gedney, Appleton, or equal.

C. Nonmetallic: Shall be type Polycarbonate/ABS construction as required for application with non-metallic quick-release latches as manufactured by Hoffman, O-Z/Gedney, Appleton, or equal.

2.2 JUNCTION AND PULL BOXES (LARGER THAN 4-11/16")

A. Oil-Tight JIC: Shall be Hoffman Type CH box or approved equal.

B. Galvanized Cast Iron or Cast Aluminum: Shall be O-Z/Gedney or approved equal.

C. Stainless Steel: Shall be as manufactured by O-Z/Gedney, Hoffman or approved equal. Boxes shall have continuous hinges, seamless foam-in-place gaskets and screw-down clamps.

D. Nonmetallic: Shall be type Polycarbonate/ABS construction as required for application with non-metallic quick-release latches as manufactured by Hoffman, O-Z/Gedney, Appleton, or equal. Boxes shall have hinged covers and screw-down clamps.

E. Wireways: Shall be standard manufacturer's item as manufactured by Hoffman, Square "D", Burns, B & C or equal. Wireways shall have hinged covers and screw-down clamps.

F. Pre-cast Polymer Concrete Below-Grade Hand Holes & Pull Boxes:
1. Enclosures, boxes and cover are required to be UL Listed and conform to all test provisions of ANSI/SCTE 77 "Specifications For Underground Enclosure Integrity" for Tier 15 applications (15,000lb design load and 22,500lb test load) unless noted otherwise.
2. All covers shall have a minimum coefficient of friction of 0.05 in accordance with ASTM C1028 and the corresponding Tier level shall be embossed on the top surface.

3. Cover shall be bolt-down include factory-labeling to read “Electric”, “Communications” or other as directed.
4. Hardware shall be stainless steel.
5. Shall be Quazite PG/LG Style or approved equal.

G. Galvanized Cast Iron Below-Grade Pull Boxes:
1. Enclosures, boxes and cover are required to conform to AASHTO H-20 requirements for deliberate vehicular traffic applications unless noted otherwise.
2. Cover shall be checkered, bolt-down include factory-labeling to read “Electric”, “Communications” or other as directed.
3. Hardware shall be stainless steel.
4. Shall be furnished with grounding kit.
5. Shall be O-Z/Gedney Type YR or approved equal.
   a.

PART 3 - EXECUTION

3.1 APPLICATION

A. General
1. All boxes and wireways shall be of sufficient size to provide free space for all enclosed conductors per NEC requirements. Fill calculations shall be performed by contractor per NEC requirements.

B. Outlet Boxes & Junction Boxes (through 4-11/16”)
1. Sheet metal boxes shall be used on concealed work in ceiling or walls and exposed work in dry, interior locations
   a. Exception: Where exposed and installed within finished/public spaces such as offices, corridors, lobbies, etc., cast boxes shall be used for wiring device outlets. Cast boxes are not required in back-of-house areas such as electrical rooms, mechanical rooms, etc. .
2. Cast boxes shall be used wherever Rigid or I.M.C. conduits are installed.
3. All boxes installed in extremely corrosive areas (such as chlorine and fluoride storage rooms) where non-metallic raceways are used shall be non-metallic.
4. Except when located in exposed concrete block, switch and receptacle boxes shall be 4" square for single gang installation. Appropriate gang boxes shall be used for mounting ganged switches.
5. When installed in exposed concrete block, switch and receptacle boxes shall be square type designed for exposed block installation.
6. Ceiling outlet boxes shall be 4" octagon 1-1/2" deep or larger required due to number of wires.
7. Boxes installed in hazardous locations shall be explosion-proof rated for the associated application, constructed of copper-free cast aluminum.

C. Junction & Pull Boxes (larger than 4-11/16”)
1. For all below grade exterior use and elsewhere as shown:
   a. In areas subject to future vehicular traffic: shall be galvanized cast iron (rated AASHTO H-20 Loading unless noted otherwise).

b. In areas not subject to vehicular traffic: shall be galvanized cast iron or pre-cast polymer concrete (rated for Tier 15 Loading unless noted otherwise).

2. All boxes installed exposed in exterior or wet areas shall be powder-coated galvanized steel (NEMA 3R).
3. All boxes installed exposed in corrosive areas shall be stainless steel (NEMA 4X).
4. All boxes installed in extremely corrosive areas (such as chlorine and fluoride storage rooms) where non-metallic raceways are used shall be non-metallic.
5. Boxes installed in hazardous locations shall be explosion-proof rated for the associated application, constructed of copper-free cast aluminum.
6. All others shall be oil tight JIC box not less than 16 gauge.

3.2 INSTALLATION

A. General
1. All boxes and wireways shall be securely anchored.
2. All boxes shall be properly sealed and protected during construction and shall be cleaned of all foreign matter before conductors are installed.
3. All boxes and wireways shall be readily accessible. Contractor shall be responsible for furnishing and installing access panels per architect's specifications. Locations shall be as directed by the architect as required to make boxes, wireways, electrical connections, etc. accessible where above gypsum board ceilings or in other similar locations.
4. All metallic boxes and wireways shall be properly grounded.
5. Refer to Specification Section 26 05 53 for identification requirements.

B. Outlet Boxes & Junction Boxes (through 4-11/16")
1. Boxes shall be provided with approved 3/8" fixture studs were required.
2. Recessed boxes for wiring devices, surface fixtures, or connections, shall be set so that the edge of cover comes flush with finished surface.
3. There shall be no more knockouts opened in any sheet metal box than actually used.
4. Any unused opening in cast boxes shall be plugged.
5. Back to back boxes to be staggered at least 3 inches.
6. Under no circumstances shall through-the-wall boxes be used.

C. Junction & Pull Boxes (larger than 4-11/16")
1. Pull boxes shall be installed as indicated on plans and/or as required due to number of bends, distance or pulling conditions.
2. Boxes to be imbedded in concrete shall be properly leveled and anchored in place before the concrete is poured.
3. All pull boxes and/or junction boxes installed exterior below grade, shall have their tops a minimum of 1-1/2 inches above surrounding grade and sloped so that water will not stand on lid. A positive drain shall be installed, to prevent water accumulation inside.
4. Above grade pull boxes shall be installed on concrete anchor bases as shown on Plans.

D. Wireways and/or wall-mounted equipment
1. Mount each wireway to channels of the same metal type as the wireway.
2. Conductors serving a wireway shall be extended without reduction in size, for the entire length of the wireway. Tap-offs to switches and other items served by the wireway shall be made with ILSCO type GTA with GTC cap.

END OF SECTION 26 05 34

SECTION 26 05 36

CABLE TRAYS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, tests and services to install complete cable tray systems as shown on the drawings.

B. Cable tray systems are defined to include, but are not limited to straight sections of cable trays, bends, tees, elbows, drop-outs, supports and accessories.

1.2 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code

B. ASTM A123 - Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip

C. ASTM A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality

D. ASTM A1011 - Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High Strength Low Alloy with Improved Formability *(Formerly ASTM A570 &A607)*

E. ASTM A1008 – Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability *(Formerly ASTM A611)*

F. ASTM B633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel

G. NEMA VE 1-2002 - Metallic Cable Tray Systems

H. NEMA VE 2-2006 - Cable Tray Installation Guidelines

I. TIA 569-A – Commercial Building Standard for Telecommunications Pathways & Spaces

1.3 DRAWINGS

A. The drawings, which constitute a part of these specifications, indicate the general route of the cable tray systems. Data presented on these drawings are as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification, of all dimensions, routing, etc., is directed.

B. Specifications and drawings are for assistance and guidance, but exact routing, locations, distances and levels will be governed by actual field conditions. Contractor is directed to make field surveys as part of his work prior to submitting system layout drawings.

1.4 SUBMITTALS

A. Submittal Drawings: Submit drawings of cable tray and accessories including clamps, brackets, hanger rods, splice plate connectors, expansion joint assemblies, and fittings, showing accurately scaled components.

B. Product Data: Submit manufacturer's data on cable tray including, but not limited to, types, materials, finishes, rung spacings, inside load depths and fitting radii. For side rails and rungs, submit cross sectional properties including Section Modulus (Sx) and Moment of Inertia (Ix).

1.5 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of cable trays and fittings of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Provide cable trays and accessories through one source from a single manufacturer.

C. NEMA Compliance: Comply with NEMA Standards Publication Number VE1, "Cable Tray Systems".

D. NEC Compliance: Comply with NEC, as applicable to construction and installation of cable tray and cable channel systems (Article 318, NEC).

E. UL Compliance: Provide products that are UL-classified and labeled in their final installed form.

F. NFPA Compliance: Comply with NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance" pertaining to installation of cable tray systems.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver cable tray systems and components carefully to avoid breakage, denting and scoring finishes. Do not install damaged equipment.

B. Store cable trays and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials should be unpacked and dried before storage.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Wire Mesh Basket type cable tray systems:
1. Subject to compliance with these specifications, wire mesh basket type cable tray systems shall be as manufactured by Eaton B-Line, Inc.; Mono-Systems, Inc, Chalfant or Legrand Cablofil.

2.2 CABLE TRAY SECTIONS AND COMPONENTS

A. Typical Cable Tray Application (applicable unless noted otherwise on plans):

1. Containing only low voltage cabling AND concealed above accessible ceilings, below raised access floors or within telecommunications rooms: Wire mesh basket type with:
   a. Useable Loading Depth: 4".
   b. Minimum Load Rating: NEMA 12C.
   c. Material: Black powder coat painted steel.
   d. Width(s): as shown on plans.
2. All other applications: Ladder-type with:
   a. Rung Spacing:9" o.c.
   b. Useable Loading Depth: 4".
   c. Minimum Load Rating: NEMA 12C.
   d. Material: Aluminum.
   e. Width(s): as shown on plans.

B. General: Except as otherwise indicated, provide metal cable trays, of types, classes and sizes indicated; with clamp assemblies, connector/splice plates, splice bars, bolts, nuts and washers for connecting units as required. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards.

C. Cable tray construction:
1. Wire Mesh Basket type cable tray systems:
   a. All straight section longitudinal wires shall be constructed with a continuous top wire safety edge. Safety edge must be kinked and T-welded on all tray sizes.
   b. Wire mesh basket type cable tray shall be made of high strength steel wires and formed into a standard 2 inch by 4 inch wire mesh pattern with intersecting wires welded together. Minimum wire diameter shall be 5mm (4.5mm for stainless steel). All mesh sections must have at least one bottom longitudinal wire along entire length of straight section.
   c. All fittings shall be factory-built or shall be formed from straight sections in accordance with manufacturer's instructions to maintain the UL Classification of the system.

D. Materials and Finish: Specific material and finish types for each tray type (as specified elsewhere) shall comply with the following general requirements:
1. Aluminum: All sections and fitting side rails and rungs shall be extruded from Aluminum Association Alloy 6063. All fabricated parts shall be made from Aluminum Association Alloy 5052.
2. Pre-galvanized Steel: All sections, fitting side rails, rungs, and covers shall be made from steel meeting the minimum mechanical properties and mill galvanized in accordance with ASTM A653 SS, Grade 33, coating designation G90.
3. Hot-dip Galvanized Steel: All sections and fitting side rails and rungs shall be made from steel meeting the minimum mechanical properties of ASTM A1011 SS, Grade 33 for 14 gauge and heavier, ASTM A1008, Grade 33, Type 2 for 16 gauge and lighter and ASTMA510, Grade 1008 for wire mesh basket type, and shall be hot-dip galvanized after fabrication in accordance with ASTM A123. All covers and splice plates must also be hot-dip galvanized after fabrication; mill galvanized covers are not acceptable for hot-dipped galvanized cable tray. All hot-dip galvanized after fabrication steel cable trays must be returned to point of manufacture after coating for inspection and removal of all icicles and excess zinc. Failure to do so can cause damage to cables and/or injury to installers.
4. Stainless Steel: All sections, accessories and fitting side rails and rungs shall be made of AISI Type 316 stainless steel. Transverse members (rungs) or corrugated bottoms shall be

welded to the side rails with Type 316 stainless steel welding wire. Wire mesh basket type shall meet minimum mechanical properties of ASTM A580.

5. Black Powder Coated steel: All sections/components shall be powder coated black with an average paint thickness of 1.2mils (30microns) to 3.0mils (75microns).

E. Accessories and Supports:

1. General:
   a. Cable Tray Supports: Shall be placed so that the support spans do not exceed maximum spans allowed to achieve the specified cable tray load ratings.
   b. Center hung supports shall be manufactured of 12 gauge, 1-5/8 inch by 1-5/8 inch B-Line B22 steel strut with a pipe welded at the middle of the support to provide eccentric loading stability. Support shall withstand 700 pounds in a 60 percent vs. 40 percent eccentric loading condition with a safety factor of 3.
   c. Accessories - special accessories shall be furnished as required to protect, support, and install a cable tray system. Accessories shall consist of but are not limited to; section splice plates, expansion plates, blind-end plates, specially designed ladder dropouts, barriers, conduit-to-tray adapters, etc.
2. Wire Mesh Basket type cable tray systems:
   a. Barrier Strips: Shall be provided where specified on plans or where cables/conductors of varying voltage classes are installed within the same tray (per NEC requirements), shall be manufactured by the tray system supplier and shall be fastened into the tray as directed by the tray system supplier.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Installers of wire mesh basket type cable tray systems shall be certified by the supplier of the cable tray system.
2. Install cable trays as indicated: Installation shall be in accordance with:
   a. Equipment manufacturer's instructions.
   b. Recognized industry practices.
   c. NEC (Article 392 and others).
   d. Applicable portions of NFPA 70B.
   e. NEMA-VE2.
3. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the owner or owner’s representative.
4. Coordinate cable tray installation with other work as necessary to properly interface installation of cable tray with other work.

B. Cabling:

1. All cabling/conductors routed in cable tray shall be rated for cable tray application.
2. Cabling/conductors of varying voltage classes installed within common trays shall be separated by barrier strips per NEC requirements.
3. Cable/conductor securing:
   a. Cables/conductors shall be secured to the transverse elements of the associated trays at the following minimum intervals:

1) Seismic, high-shock or vibration prone areas (such as mechanical rooms, process areas, etc.):
   a) All cables/conductors: 24".
2) Non-horizontal cable tray sections:
   a) All cables/conductors: 36".
3) Horizontal cable tray sections:
   a) All power cables/conductors: 36"
   b) Control, instrumentation and network cables in cable trays in exposed areas: 36"
   c) Control, instrumentation and network cables in cable trays in concealed interior areas (such as above lay-in ceilings): No cable ties required.

b. All cable ties used to secure cables to trays in interior areas shall be plenum-rated plastic. Cable ties used in interior exposed areas (subject to light) in interior areas shall be sunlight/UV-resistant. Cable ties used in exterior environments shall be of non-magnetic stainless steel construction.

4. Cable/conductor arrangement:
   a. Provide separation between power cables/conductors within cable trays for proper heat dissipation (and conductor ampacity ratings) per NEC requirements.

C. Bonding:
1. Ground and bond metal cable tray in accordance with NEC Articles 392, 250.96 and 250.102.
   a. Provide continuity between all metal cable tray components.
   b. Make connections to tray using mechanical, compression or exothermic connectors.
2. Cable trays shall be properly bonded with grounding harnesses or other necessary equipment as required to all metal conduits terminating into the cable trays and between cable tray sections.

D. Location/Routing:
1. Location of cable tray shown on plans is for general routing only. Field coordinate exact cable tray locations/routing with all piping, equipment, ductwork, structure, lighting, etc. & other trades prior to ordering cable tray. Provide vertical & horizontal bends as required, maintaining proper clearance around cable trays.
2. Coordinate cable tray with all other work as necessary to properly integrate installation of cable tray work with other work. Any potential conflicts between locations of cable trays and locations of other items shall promptly be brought to the attention of the engineer prior to installation.
3. Provide a minimum of 6" clearance on top of cable trays and 3" clearance on bottom and sides of cable trays to permit access for installing and maintaining cables unless specifically approved or directed otherwise by engineer.

E. Support:
1. Cable tray fitting supports shall be located such that they meet the strength requirements of straight sections. Install fitting supports per NEMA VE-2 guidelines, or in accordance with manufacturer's instructions.
2. Trapeze hangers and center-hung supports shall be supported by 1/2 inch (minimum) diameter all-thread rods unless noted otherwise. Trapeze hangers supporting wire mesh basket type cable trays 12" wide or less may be supported by 3/8 inch (minimum) diameter all-thread rods.

F. Penetrations:
1. Where cable trays pathways pass through walls, floors, ceilings or other similar partitions that are fire-rated, smoke-rated, designed to prevent water entry, designed to limit sound transmission, or designed to limit air passage (for environmental or conditioning purposes), cable trays themselves shall not penetrate the partition but shall be terminated on either side of the partition. The partition shall be penetrated with conduit sleeves sealed with suitable fire caulk or other approved material, per specific instructions of the caulk supplier to maintain partition/etc. ratings (such as fire or smoke ratings), after installation of all cabling. Bonding jumpers shall be provided through sleeves to ensure electrical continuity of cable tray system. Interior cross-sectional area of the conduit sleeves shall match or exceed the interior cross-sectional area of the associated cable tray(s).
2. Contractor shall verify arrangement, sizes and locations of all penetrations through load-bearing walls, floors or other structural items with structural engineer. Contractor shall submit sketch of proposed sleeve locations to structural engineer for review prior to rough-in.

G. Marking:
1. Cable trays containing conductors rated over 600 volts shall have a permanent, legible warning notices installed per NEC 392 requirements.

3.2 TESTING

A. Test cable trays to ensure electrical continuity of bonding and grounding connections. See NFPA 70B, Chapter 18, for testing and test methods.

B. Manufacturer shall provide test reports witnessed by an independent testing laboratory of the "worst case" loading conditions outlined in this specification and performed in accordance with the latest revision of NEMA VE-1; including test reports verifying rung load capacity in accordance with NEMA VE-1 Section 5.4.

END OF SECTION 26 05 36

SECTION 26 05 53

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Wire and cable identification.

B. Pullbox & Junction Box Identification

C. Electrical distribution & utilization equipment identification.

D. Emergency and Standby Power receptacle identification.

PART 2 - PRODUCTS

2.1 WIRE AND CABLE IDENTIFICATION

A. Intermediate Locations:
1. Wires and cable labels shall be white, thermal transfer, halogen-free, flame-retardant marker plates (sized to accommodate three lines of text) permanently affixed to the associated cable with UV-resistant plastic wire ties. Labels shall be Panduit #M200X/300X series or equal.

B. Circuit/Cable Termination Locations:
1. Wires and cable labels shall be non-ferrous identifying tags or pressure sensitive labels unless noted otherwise.

2.2 ELECTRICAL DISTRIBUTION & UTILIZATION EQUIPMENT IDENTIFICATION

A. Labels on electrical distribution & utilization equipment shall be black-on-white engraved Bakelite nameplates permanently affixed to the equipment with rivets or silicone adhesive unless noted otherwise.

B. Labels on electrical distribution equipment fed from emergency or legally-required standby sources (such as emergency generators) shall be white-on-red engraved Bakelite nameplates permanently affixed to the equipment with rivets or silicone adhesive.

2.3 EMERGENCY AND STANDBY POWER RECEPTACLE IDENTIFICATION

A. Receptacles fed from emergency or standby power sources (such as emergency generators) shall be provided with factory-marked engraved coverplates as follows:
1. Emergency System source: Red engraved lettering to read “EMERGENCY”.
2. Legally-Required or Optional Standby Generator source:
   a. If only part of facility is fed with generator backup: Black engraved lettering to read “FED FROM GENERATOR”.
   b. If entire facility is fed with generator backup: No “….GENERATOR…” label required.

PART 3 - EXECUTION

3.1 GENERAL

A. Any proposed deviation in identification methods and materials from those described herein shall be submitted to Architect for review and comment prior to installation.

B. Contractor shall provide all labeling or identification required by applicable local, state and national codes. These specifications do not intend to itemize all code-required labeling or identification requirements.

C. All labels/identification shall be positioned such as to be readable from the normal perspective without adjusting wiring/cables/labels. For example, labels/identification of wires/cables within cable trays shall be positioned to point towards the viewer (typically downward for overhead cable trays, or upward for cable trays within trenches).

D. All labels/identification (except for handwritten labels on concealed pullbox/junction box covers as noted below) shall be typewritten/printed/engraved in a neat, workmanlike, permanent, legible, consistent and meaningful manner. Labels shall not be handwritten unless specific approval is granted by engineer.

3.2 WIRE AND CABLE IDENTIFICATION

A. General:
1. Where cabling is exposed (such as within cable trays), provide two wire ties per cable (one on either end of marker plate to provide a flush installation). Where cabling is concealed (such as within pullboxes/wireways), one wire tie per cable will be acceptable.

B. Intermediate Locations:
1. Thermal transfer labels shall be securely fastened to all wiring and cabling in the following locations:
    a. Wireways
    b. Pullboxes/Junction boxes larger than 4-11/16”
    c. Pullboxes/Junction boxes through 4-11/16” where wires and cables are not easily identifiable via the color coding and box labeling
    d. Vaults & Manholes
    e. Approximately every 50 feet within cable trays (especially at locations where cables exit or diverge). Labels within cable trays shall be grouped (rather than being pre-labeled on cables and pulled into cable trays).
    f. Other similar intermediate locations.
2. Labels shall be stamped or printed with the following data so that the feeder or cable can be readily identified and traced:
    a. From where the circuit originates (including panel designation and circuit number):
        1) Ex: “FROM: PP-A CIR. 3 (IN MAIN ELEC ROOM)”
    b. To where the circuit extends (using the common name of the equipment):
        1) Ex: “TO: RTU-6 (ON ROOF)”
    c. The purpose of the circuit:
        1) Ex: “POWER”
    d. The set number (If parallel power feeds are used).
        1) Ex: “SET NO. 3 OF 4”

C. Circuit/Cable Termination Locations:
1. Where multiple termination points exist within a circuit origination point (panelboard, switchboard, MCC, starter, etc.) or other similar circuit endpoint (control panel, etc.), labels shall be securely fastened to all ungrounded and neutral conductors to clearly identify the terminal and/or circuit number associated with each conductor. For example, within lighting panels, each phase and neutral conductor shall be labeled near the terminals at a clearly visible location with the associated circuit number(s), so that if all conductors were unterminated, the labels would clearly indicate which conductor was associated with each circuit.

D. Refer to Specification Section 26 05 19 for all color-coding requirements of wires and cables.

3.3 PULLBOX & JUNCTION BOX IDENTIFICATION

A. Concealed pullboxes/junction boxes:
1. Front surface of all pullbox/junction box covers in concealed areas (such as above lay-in ceilings) or within mechanical/electrical rooms (and other similar areas where appearance of boxes is not an issue) shall be neatly marked with the ID of circuits/cables contained with permanent black marker on cover of box (Ex: “RP-1A Cir. 1, 2 & 3”). Additionally, front surface of box shall be painted red where box contains fire alarm system cabling.

B. Exposed pullboxes/junction boxes:
1. Interior surface of all pullbox/junction box covers in exposed areas shall be labeled “Power”, “Telecommunications”, “Fire Alarm” or with other similar general text neatly with permanent black marker to indicate function of box. Circuit/cable labeling within box (see above) shall identify specific cables contained. Additionally, interior surface of cover shall be painted red where box contains fire alarm system cabling.

C. Where pullboxes/junction boxes are named on contract documents (Ex:”PULLBOX #3”), an engraved nameplate shall be installed on the front surface of the box to identify the name.

3.4 ELECTRICAL DISTRIBUTION & UTILIZATION EQUIPMENT IDENTIFICATION

A. General:
1. All new and existing equipment modified by this project shall include arc-flash warning labels in accordance with NEC article 110.16.

B. All Panels, Motor Control Centers, Switchboards, Switchgear, Transformers, Etc.:
1. Engraved nameplates identifying name of equipment, nominal voltage and phase of the equipment and where the equipment is fed from shall be installed on front surface of all panels, motor control centers, switchboards, switchgear, transformers, etc.:
   a. Ex: First Line: “NAME: RP-A”, Second Line: “120/208V-3Ø-4W”, Third Line: “FED FROM: PP-A CIR. 4 (IN MAIN ELEC ROOM)”
2. Refer to Panelboard Specification Sections for additional labeling requirements (circuit directory cards, permanent circuit labels, permanent circuit numbers, etc.) required inside panelboards.

C. Safety/Disconnect Switches and Utilization Equipment (HVAC Equipment, Pumps, Powered Valves, Control Panels, Starters, Etc.)::
1. Engraved nameplates identifying equipment being fed and where the equipment is fed from shall be installed on front surface of all disconnect switches (including both visible blade

type switches and toggle-type switches) and on utilization equipment (where not clearly identified by immediately adjacent local disconnect switch):
   a. Ex: First Line: "RTU-6", Second Line: "FED FROM: PP-A CIR. 5"
2. Where safety/disconnect switches are installed on the load side of variable frequency drives, the safety/disconnect switch shall be furnished with an additional engraved nameplate to read: "WARNING: TURN OFF VFD PRIOR TO OPENING THIS SWITCH".
3. Safety/Disconnect switches feeding equipment that is fed from multiple sources (such as motors with integral overtemperature contacts that are monitored via a control system) and Utilization Equipment fed from multiple sources shall be furnished with an additional BLACK-ON-YELLOW engraved nameplate to read: "WARNING: ASSOCIATED EQUIPMENT FED FROM MULTIPLE SOURCES – DISCONNECT ALL SOURCES PRIOR TO OPENING COVER".

D. Emergency Systems:
1. A sign shall be placed at the service entrance equipment (and at any remote shunt trip operators, or similar, for service equipment) indicating the type and location of on-site emergency power sources (such as generators, central battery systems, etc.) per NEC requirements.
2. All boxes and enclosures (including transfer switches, generators, power panels, junction boxes, pullboxes, etc.) dedicated for emergency circuits shall be permanently marked with white-on-red engraved nameplates so they will be readily identified as a component of an emergency circuit or system.
3. Where an Essential Electrical System (EES) is installed, all enclosures, raceways and equipment that are components of the EES shall be readily identified as such. Raceway shall be identified at intervals not exceeding 25 ft.

E. Services:
1. All Service Equipment:
   a. Engraved nameplates identifying maximum available fault current, including date the fault current calculation was performed, in accordance with NEC article 110.24.
      1) Ex: First Line: "AVAILABLE FAULT CURRENT: 16,154 AMPS", Second Line: "DATE CALCULATED: JULY 8, 2013"
   b. All service entrance equipment shall be clearly labeled as being service entrance rated.
2. Where a building or structure is supplied by more than one service (or any combination of branch circuits, feeders and services), a permanent plaque or directory shall be installed at each service disconnect location denoting all other services, feeders & branch circuits supplying that building or structure and the area served by each, per NEC requirements.

F. Generators:
1. Generators shall be labeled with engraved nameplates identifying name of equipment.

3.5 EMERGENCY AND STANDBY POWER RECEPTACLE IDENTIFICATION

A. Receptacles fed from emergency or standby power sources (such as emergency generators) shall be provided with factory-marked engraved coverplates as described above.

3.6 OTHER IDENTIFICATION

A. Factory-engraved coverplates identifying functions of light switches and other similar devices shall be installed where so required by plans/specifications.

END OF SECTION 26 05 53

SECTION 26 09 43

LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.1 INTRODUCTION

A. The work covered in this section is subject to the requirements in the General Conditions of the Specifications. Contractor shall coordinate the work in this section with the trades covered in other sections of the specification to provide a complete and operable system.

1.2 SYSTEM DESCRIPTION

A. Extent of lighting control system work is indicated by drawings and by the requirements of this section. Contractor shall furnish and install a complete, integrated, stand alone automatic lighting control system including programmable Lighting Control Panels with internal astronomic timeclock(s), Networking between panels, Dataline low voltage control switch inputs for zone control, Photocell input for outdoor lighting control, Occupancy Sensors, and Daylighting Controls from a single supplier. Contractor is responsible for confirming that the panels and sensors interoperate as a single system.

1.3 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Comply with NEC, NEMA, and FCC Emission requirements for Class A applications.

C. UL Approvals: Relay panels and accessory devices are to be UL listed under UL 916 Energy Management Equipment. Configured to order or custom relay panels shall be UL Listed under UL 508, Industrial Control Panels.

1.4 SUBMITTALS

A. Submittals Package: Submit the shop drawings, and the product data specified below at the same time as a package.
   1. Shop Drawings: Building floorplans showing all proposed devices and composite wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted).
   2. Product Data: Catalog sheets, specifications and installation instructions.

1.5 APPROVED MANUFACTURERS

A. Watt Stopper/Legrand – Lighting Integrator series

B. Equal by Acuity Lighting

C. Any other system wishing to be considered must submit descriptive information 10 days prior to bid. Prior approval does not guarantee final approval by the electrical engineer. The contractor shall be completely responsible for providing a system meeting this specification in its entirety.

All deviations from this specification must be listed and individually signed off by the consultant.

PART 2 - PRODUCTS

2.1 LIGHTING CONTROL PANELS

A. Provide lighting control panels in the locations and capacities as indicated on the plans and schedules. Each panel shall be of modular construction and consist of the following components:

1. Enclosure/Tub shall be NEMA 1, NEMA 3R, or NEMA 4 as indicated on the plans, sized to accept an interior with 1-8 relays, 1-24 relays and six (6) four pole contactors, or 1-48 relays with six (6) four pole contactors, per enclosure. Multiple enclosures shall be provided where required for the specified quantities of relays/contactors.
2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. The panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. The interior construction shall provide total isolation of high voltage (class 1) wiring from low voltage (class 2) wiring within the assembled panel. The interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. The panel interiors shall include the following features:
    a. Provision for one or two optional control and automation cards.
    b. Removable, plug-in terminal blocks with screw less connections for all low voltage terminations.
    c. Individual terminal block, override push button, and LED status light for each relay
    d. Switch inputs associated with each relay and group channel shall support two or three wire, momentary or maintained contact switches or 24VDC input from occupancy sensors.
    e. Automatic support for occupancy sensor sequence of operation. Low voltage inputs automatically reconfigure when connected to a Watt Stopper occupancy sensor head. Occupancy sensor shall switch lighting on and off during unoccupied periods but shall not turn lighting off during scheduled occupancy periods.
    f. Isolated contacts within each relay shall provide true relay state to the electronics. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems.
    g. Automatic sequenced operation of relays reduces impact on the electrical distribution system when large loads are controlled simultaneously.
    h. Group, channel, and pattern control of relays shall be provided through a simple button-press interface within the panel. Any group of relays can be associated with a channel for direct on/off control or pattern (scene) control via a simple programming sequence using the relay and channel override push buttons and LED displays.
    i. Relay group status for each channel shall be provided through bi-color operation of the LED indicators. Solid red indicates that all relays in the group are on, solid green indicates that the group is in a mixed state, and blinking green indicates that the relays have blink warned and are currently timing out.

j. Each relay and channel terminal block shall provide a 24V pilot light signal. It shall be possible to configure the system for support for any Class 2 pilot light voltage with the use of an auxiliary power supply.
k. Single pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
   1) Electrical:
      a) 30 amp ballast at 277V
      b) 20 amp ballast at 347V
      c) 20 amp tungsten at 120V
      d) 30 amp resistive at 347V
      e) 1.5 HP motor at 120V
      f) Short circuit current capacity equal to (or greater than) that of the associated circuits (see associated panelboard schedules on drawings)
   2) Mechanical:
      a) Individually replaceable, ½" KO mounting with removable Class 2 wire harness
      b) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel
      c) Dual line and load terminals each support two #14 – #12 solid or stranded conductors
      d) Tested to 300,000 mechanical on/off cycles
   3) Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
l. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.

2.2 LONWORKS® BASED DIGITAL COMMUNICATIONS

A. The lighting control panel shall support digital communications to facilitate the extension of control to include multiple panels and other intelligent field devices. Digital communications shall be LonWorks® based and use the LonTalk® protocol in an open topology architecture.
   1. Dataline communications wire shall be 18 AWG, 4 unshielded copper conductors (two independent twisted pairs) meeting Class 2P NEC code requirements. The dataline shall be topology free and can be run in a serial, "T"or star configuration.
   2. The Dataline wire will be supplied by the equipment manufacturer and will include the manufacturers name, catalog number printed on the wire jacket. The contractor, at their own expense will, replace an improper dataline wire.
   3. Panels shall be digitally addressed and support bi-directional communication between each other and other intelligent field devices specified elsewhere.
   4. Intelligent field devices supported shall include digital dataline switches, network clock/programmer, telephone interface module, BMS interface module, photocell control module, programmable thermostat, and universal switch module.

2.3 BROWSER BASED PROGRAMMING AND CONTROL

A. The lighting control system shall include a web browser based user interface that shall allow programming and override of the system from any PC browser with network connectivity to the lighting controls. The Automation Appliance shall include as a minimum the following

features:

1. The interface shall be a TCP/IP based server device that is connected to the lighting control system global dataline and shall not require that software be installed on the client PC(s) for operation.
2. Provide support for connection of one or more personal computers directly via Ethernet or enterprise connectivity via a local area network, wide area network or internet connection.
3. Provide the option for a plug-in 56K baud modem to enable dial in connection via standard telephone line. All functionality of the browser interface shall be available through the dial-up connection.
4. Log in to the lighting control system through the browser interfaced shall provide multi-level security. Users shall be assigned log in access levels to restrict program modification to authorized users.
5. User programming shall include eight independent schedules for each lighting control panel, as well as, eight global schedules that affect channels in all panels on the network. Schedules shall overlap such that a panel specific schedule for any channel will override a global schedule for that channel.
6. Schedules shall be capable of seven day repeating and calendar date event based formats.
7. User programming shall be scenario based and shall include the following options:
   a. Scheduled ON / OFF
   b. Manual ON / Scheduled OFF
   c. Manual ON / Auto Sweep OFF (for AS-100 Switches)
   d. Astro ON / OFF (or Photo ON / OFF)
   e. Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
8. It shall be possible to view the status of and override any relay or channel group via the browser interface screens.
9. Provide support and user interface screens for integration of the photocontrol module, dataline switches, touch-tone telephone module, and universal switch module.
10. Provision for integration with the building automation system shall be via the industry standard BACnet protocol. Any of the eight global schedule channels shall individually be set to follow the BAS schedules rather than the internal Automation Appliance schedules. Relays in all panels shall be exposed to the BAS as binary output objects. It shall be possible for the BAS to read the status of each relay and to override each relay via BACnet.
11. The interface shall monitor all networked components and automatically generate alarms if any component fails to properly respond to control. Alarms shall be annunciated via the browser screens and via email to selected recipients where a proper SMTP server connection has been set up.
12. The user programming in the lighting control panels and dataline switches shall be available for viewing or download to the client PC as a standard PDF file.
13. A backup function shall permit the complete system program to be saved to the hard drive of any client PC connected to the lighting control system through the browser interface. A restore function shall allow a saved program to be reloaded to the interface.

2.4 EIGHT CHANNEL DIGITAL PHOTOCONTROL MODULE

A. Provide a weatherproof Class 2 photocell for measuring exterior light levels. The photocell shall be mounted facing north as indicated on the plans. The photocell shall be connected to a photocontrol module mounted on the DIN rail inside the low voltage section of a lighting control panel and connected to the dataline communications wire.

1. The photocontrol Module shall integrate seamlessly with either the Network Clock, Automation Appliance, or the BMS Interface Module. The control module shall measure the actual exterior light and display this level in foot candles (fc) on the unit LCD display.
2. The controller shall have eight individual set point adjustments that are available to the lighting control network over the dataline communications wire.
3. Features
   a. Real time, 2 line LCD display of actual exterior light level up to 200 fc.
   b. Channel set points and parameters programmed via the Network Clock or BMS Interface Module.
   c. Choice of OPERATE or TEST modes, with simulated light level for testing.
   d. Automatic dead band and 5 minute time delay to avoid cycling.

2.5 DIGITAL DATALINE SWITCHES

A. Intelligent digital switching shall be provided operating on the dual twisted pair communication wire. Switches shall be available in single, dual, quad, or octal (1-button, 2-button, 4-button, or 8-button) designs. The single, dual, and quad devices shall mount in a standard single-gang box, the octal version in a two-gang box.
   1. Each button shall be individually programmable. Programming of buttons shall not require the use of a computer or other programming device. It shall be possible to assign relays or channels to buttons using a simple button press interface. Each button can control any one of the following options:
      a. Any individual relay in any single panel.
      b. Any group of relays in any single panel.
      c. Any group of relays in the system (via network clock, Automation Appliance, or WinControl software package).
   2. For applications that require pattern switching, buttons shall function as a scene control using an ON/OFF/Not Controlled pattern of relays instead of the normal All ON/OFF.
   3. Switches shall be constructed of non-breakable grey Lexan on all exposed parts and shall include a stainless steel wall plate, unless noted otherwise on plans.
   4. Individual buttons shall have a removable clear cover to allow standard 9 mm (3/8 inch) labeling tape to be used to identify the controlled loads.
   5. Each switch shall use a bi-color LED pilot light for the individual buttons to indicate status of the controlled relay or group of relays. LED indications are Red for All ON, Green for Mixed State (some relays in the group ON and others OFF), and No LED for All OFF.
   6. Switch LED pilot lights shall flash green to indicate impending off sweep during the five-minute grace period following blink warning of the lights. Once the button is pressed, the LED will change to Red to acknowledge the occupant's override command to keep lights ON.
   7. Multiple dataline switches programmed to control the same relay or relay group shall indicate the same status automatically.
   8. Each switch shall also include a locator light illuminating the switch for easy location in the dark.
   9. The dual, quad, and octal switches shall all include a single master button that will override all relays controlled by the individual buttons OFF, or Restore them to their original state. Each switch's master button configuration can be altered to perform a Master ON/OFF, OFF Only, or Disabled function if desired.
   10. Switches can be configured to follow a "Cleaning" scenario. This specific scenario shall prevent the cleaners from overriding OFF any relays previously turned ON by an occupant.

11. Each switch is available in a Key lock override version. Once a key is inserted, the individual buttons will function for five minutes.

2.6 AUTOMATIC LIGHTING CONTROLS

A. System shall provide automatic lighting shutoff for all interior lighting circuits controlled by the system (excluding night lights and other similar circuits) per latest ASHRAE 90.1 & IECC standards, unless specifically shown otherwise on plans.

B. System shall provide blink-warnings for interior lighting circuits (excluding circuits with HID light fixtures) controlled by the control panel 5 minutes prior to automatic shutoff.

C. System shall include provisions for holiday scheduling, to allow automatic “ON” programming to be skipped on holidays and other scheduled off days per applicable energy code requirements.

D. Low voltage remote override switches shall be provided as shown on drawings.

E. Exact preset times for lighting control zone controls (where applicable) and lighting control system operation shall be per owner’s direction. Contractor shall submit a proposed lighting control schedule indicating type of “ON” control (occupancy, time-of-day, manual, etc.), type of “OFF” control (occupancy, time-of-day, manual, etc.) and proposed preset times for all zones to owner for review prior to implementation. The following general control schemes shall generally be used where the owner has no preferences unless shown otherwise on plans:
1. Exterior Security Lighting (at doorways, etc.):
    a. On: Photocell or Astronomic – dusk.
    b. Off: Photocell or Astronomic – dawn.
2. Other Exterior Lighting:
    a. On: Photocell or Astronomic – dusk.
    b. Off: Preset Time (as directed by the facility operator).
3. Interior Lighting with Occupancy Sensor Controls:
    a. Corridors, restrooms, lobbies and other similar public spaces
        1) On: Occupancy Sensor.
        2) Off: Occupancy Sensor.
    b. Storage rooms, janitor's closets, telecommunications rooms, and other similar unoccupied spaces:
        1) On: Occupancy Sensor.
        2) Off: Occupancy Sensor.
    c. Offices, classrooms, breakrooms, conference rooms, work areas, kitchens, gymnasiums, and other similar occupied spaces:
        1) On:
            a) Manual Local Switch (if digital controls are provided) or
            b) Occupancy Sensor (if hardwired controls are provided).
        2) Off: Occupancy Sensor (A "grace period" shall be provided, in which the occupancy sensor can turn lights back "on" for a short period of time (approximately 15 seconds) after lights are turned off automatically).
4. Interior Lighting with Time-of-Day Controls:
    a. Corridors, restrooms, lobbies and other similar public spaces
        1) On: Preset Time (as directed by the facility operator).
        2) Off: Preset Time (as directed by the facility operator).

b. Storage rooms, janitor's closets, telecommunications rooms, and other similar unoccupied spaces:
   1) On: Manual Local Switch
   2) Off: Preset Time (as directed by the facility operator).
c. Offices, classrooms, breakrooms, conference rooms, work areas, kitchens, gymnasiums, and other similar occupied spaces:
   1) On: Manual Local Switch
   2) Off: Preset Time (as directed by the facility operator).

2.7 WIRING

A. See Specification Section 27 05 00 for additional requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Specification Section 27 05 00 for additional cable installation requirements.

B. Master/centralized lighting control switches (particularly switches located in areas where not all associated lighting fixtures are visible from the switch) and individual buttons of other lighting control stations with more than two (2) buttons shall be labeled (on switch coverplate or directly on buttons) with factory-engraved labeling. Exact wording of labeling shall be per owner's direction unless shown otherwise on plans.

3.2 SUPPORT SERVICES

A. Pre-installation Coordination
1. Exact occupancy sensor and daylight sensor types and locations shall be determined by the lighting control system supplier for a fully-functional system with adequate coverage throughout areas controlled by occupancy sensors. Exact locations shall be coordinated with actual HVAC register locations, furniture/casework/etc. locations, sensor coverage patterns, etc. for proper coverage in all areas. In no case may fewer devices or lower-quality devices be used in each area than indicated on contract documents.

B. System Start Up and Commissioning
1. The electrical contractor shall provide the manufacturer, the facility owner and the electrical engineer with ten working days written notice of the system startup and adjustment date.
2. Manufacturer shall provide a factory authorized technician to confirm proper installation and operation of all lighting control system components. The startup requirement is intended to verify:
   a. That all occupancy and daylighting sensors are located, installed, and adjusted as intended by the factory and the contract documents.
   b. The occupancy sensors and daylighting sensors are operating within the manufacturers specifications.
   c. The sensors and relay panels interact as a complete and operational system to meet the design intent.
3. Manufacturer to provide a written statement verifying that the system meets the above requirements.

C. Re-commissioning – After 30 days from occupancy re-calibrate all preset times, sensor time

delays and sensitivities and relocate occupancy sensors if so required to meet the Owner's Project Requirements. Provide a detailed report to the Design Team and Owner of re-commissioning activity.

D. System Training
1. Manufacturer shall provide factory authorized technician to train owner personnel in the operation, programming and maintenance of the lighting control system including all occupancy sensors and daylighting controls.

E. System Programming
1. Manufacturer shall provide system programming including:
   a. Wiring documentation.
   b. Switch operation.
   c. Telephone overrides.
   d. Operating schedules.

3.3 WARRANTY

A. The contractor shall warrant the completed lighting control system to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the completed and certified test or from the date of first beneficial use.

END OF SECTION 26 09 43

SECTION 26 24 16

POWER PANELBOARDS - CIRCUIT BREAKER TYPE

PART 1 - GENERAL

1.1 GENERAL

A. The work under this section includes but is not limited to the following:
1. Power Panelboards
2. Power Circuit Breakers

PART 2 - PRODUCTS

2.1 PANELBOARDS - GENERAL

A. Panelboards shall be dead front type, having lugs only or circuit breaker in mains as shown in panelboard schedule with circuit breaker branches.

B. Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on plans. Such rating shall be established by heat rise test with Maximum hot spot temperature on any connector or bus bar not to exceed 50 degrees C rise above ambient at full rated load. Heat rise test shall be conducted in accordance with UL Standard UL67. Bus structure shall be tin-plated aluminum or tin-plated copper. All neutral busses shall be full size. All panelboards shall contain ground buss.

C. Entire panelboard assembly, including all bussing, shall have SCCR ratings meeting or exceeding the minimum AIC ratings listed on the plans for the panel. All ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.

D. Panelboards shall be listed by Underwriters Laboratories and shall bear the UL label. Panelboards shall be suitable for use as service equipment when required.

E. Top/bottom feed arrangement and lug sizes/quantities shall be coordinated by the contractor.

F. Service entrance panelboards shall be provided with barrier such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations**.**

2.2 CIRCUIT BREAKERS

A. Where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated (or can be adjusted to is 1200A or higher, breakers shall be electronic trip and shall be provided with arc energy-reducing maintenance switching (with local status indicator) to reduce arc flash energy per NEC 240.87 requirements.

B. Circuit breakers shall be quick-make and quick-break, whether actuated automatically or manually. Circuit breakers shall have inverse time tripping characteristics with automatic release which shall trip free of the handle. Circuit breaker handles shall be three distinct positions—“OFF”, “ON”, and “TRIPPED”. When a circuit breaker opens on overload or short

circuit, the operating handle shall automatically assume the "TRIPPED" position.

C. Multipole breakers shall be internal common trip with single operating handle. External handle ties are not acceptable, unless specifically noted otherwise (such as for multi-wire branch circuits described below).

D. Circuit breakers feeding multiwire branch circuits (as defined by NEC) consisting of separate single phase loads sharing a common neutral shall be provided with handle ties to simultaneously disconnect all ungrounded conductors per NEC Article 210.4(B). The necessary locations of these handle ties shall be coordinated by the contractor. Where necessary, the contractor may rearrange circuit breakers (as minimally as possible) as required to meet this requirement.

E. Circuit breakers shall be of the bolt-on type.

F. Circuit breakers shall be "FA" frame and larger.

G. All breakers shall meet the minimum RMS symmetrical interrupting capacity ratings shown on plans for the associated panel. All interrupting ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.

H. The front face of all circuit breakers shall be flush with each other. Breaker numbers shall be permanently attached to trim.

I. All branch circuit breakers shall be listed to UL489 or shall be specially-tested to be HACR listed.

2.3 CABINETS, TRIM AND WIREWAY SPACE

A. Clear space from bottom of lugs to bottom of wireway shall be not less than 6 inches for 400 amps and below, 10 inches for 600 amps, 12 inches for 800 amps and above.

B. Panelboard interiors shall be fastened to cabinets by adjustable aligning supports.

C. Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets.

D. Fronts of cabinets shall be made from a single sheet of full finished steel having the door cut out. Doors shall have flush hinges, and lock utilizing all metal construction (with all locks keyed alike). Front shall be attached to cabinets with hinged trim with piano-hinge down full length of one side to allow access to wiring without complete removal of outer trim. Front shall be provided with a metal directory and holder with clear plastic covering welded to the inside of the door. Fronts shall be code gauge full-finished steel with rust inhibiting primer and baked enamel finished in ASA #49 gray. Panelboards installed in exterior or wet locations shall have NEMA 3R enclosures.

E. Each section of multi-section panelboards shall be of matching heights and depths.

F. Panelboard enclosures shall be furnished as shown on panel schedule on plans for surface, flush or motor control center mounting.

2.4 MANUFACTURER

A. Panelboards shall be as manufactured by Square 'D', G.E., Siemens or Cutler Hammer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All panelboard dimensions and clearances shall be carefully checked and coordinated with the proper trades to insure proper mounting space and support prior to roughing in equipment. In no case shall any circuit breaker be located above 6’-7” A.F.F..

B. Wiring in panelboard gutters shall be done in a neat and workmanlike manner. Wiring shall be grouped into neat bundles and secured with approved tie wraps.

3.2 PANEL IDENTIFICATION

A. Refer to Specification Section 26 05 53.

END OF SECTION 26 24 16

SECTION 26 24 17

LIGHTING PANELBOARDS

PART 1 - GENERAL

1.1 GENERAL

A. The work under this section includes but is not limited to the following:
1. Lighting Panelboards
2. Circuit Breakers

PART 2 - PRODUCT

2.1 PANELBOARDS

A. Enclosure:
1. Panelboards shall be dead front type and shall be in accordance with Underwriter's Laboratories, Inc., standard of panelboards and enclosing cabinets and so labeled.
2. Panelboards installed in dry locations shall have enclosures fabricated from sheet steel and shall be finished in ASA #49. Panelboards installed in exterior or wet locations shall have NEMA 3R enclosures.
3. The door shall have a cylinder type lock. Lock shall be held in place by concealed screw to a captive nut, welded to inside of door. All locks shall be keyed alike.
4. A metal framed circuit directory card holder with clear plastic covering shall be factory-mounted on the inside of door.
5. Panels for 20 or more circuits, including spares and spaces, shall be 20 inches wide.
6. Panelboards enclosures shall be as shown on panel schedule on plans for surface, flush or motor control center mounting.
7. Provide hinged trim with piano-hinge down full length of one side to allow access to wiring without complete removal of outer trim.
8. Each section of multi-section panelboards shall be of matching heights and depths.

B. Bussing/Lugs:
1. Ampacity and service voltage of main buss, lugs or main breakers and branch circuit breakers shall be as shown on drawings.
2. All bussing and associated connectors shall be tin-plated aluminum or tin-plated copper.
3. All panelboards shall contain ground buss.
4. Entire panelboard shall be capable of withstanding a short circuit not less than the interrupting capacity of any breaker in the panel. When a power distribution system electrical study (including short circuit stud, etc.) is a part of the project, contractor shall further verify that all proposed equipment is properly rated (per the results of the study) prior to submitting shop drawings. Interrupting ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.
5. Buss connectors shall be for distributed phase arrangement.
6. Top/bottom feed arrangement and lug sizes/quantities shall be coordinated by the contractor.
7. Entire panelboard assembly, including all bussing, shall have SCCR ratings meeting or exceeding the minimum AIC ratings listed on the plans for the panel. When a power

distribution system electrical study (including short circuit stud, etc.) is a part of the project, contractor shall further verify that all proposed equipment is properly rated (per the results of the study) prior to submitting shop drawings. All ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.

8. Service entrance panelboards shall be provided with barrier such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations

C. Breaker arrangement and numbering:
   1. Panelboards shall be factory assembled with branch breakers arranged exactly as indicated on plans.
   2. Breakers shall be numbered vertically beginning top left. Multi-section panelboards shall be numbered consecutively through all sections.
   3. Breaker numbers shall be permanently attached to trim.
   4. Main breakers shall be vertically-mounted (branch-mounted or back-fed main breakers will not be acceptable unless specifically so shown on plans).

2.2 CIRCUIT BREAKERS

A. Circuit breakers shall be quick break, quick make, thermal magnetic type, for alternating current. Breakers shall trip free for the handle and tripping shall be indicated by the handle assuming a position between OFF and ON.

B. Circuit breakers shall be of the bolt-on type.

C. Multi-pole breakers shall be internal common trip with single operating handle; external handle ties are not acceptable, unless specifically noted otherwise (such as for multi-wire branch circuits described below).

D. Circuit breakers feeding multiwire branch circuits (as defined by NEC) consisting of separate single phase loads sharing a common neutral shall be provided with multi-pole breakers or handle ties to simultaneously disconnect all ungrounded conductors per NEC Article 210.4(B). The necessary locations of these multi-pole breakers or handle ties shall be coordinated by the contractor. Where necessary, the contractor may rearrange circuit breakers (as minimally as possible) as required to meet this requirement.

E. All breakers shall meet the minimum RMS symmetrical interrupting capacity ratings shown on plans for the associated panel. All interrupting ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.

F. All branch circuit breakers shall be listed to UL489 or shall be specially-tested to be HACR listed.

2.3 SPECIAL REQUIREMENTS

A. Any special requirements on the drawings, such as for increased interrupting rating, ground fault protection, etc., shall supersede these specifications, but only insofar as that particular requirement is concerned.

B. Lighting panels larger than 400A shall conform to the requirements for power panels.

2.4 MANUFACTURER

A. Panelboards shall be as manufactured by Square 'D', G.E., Siemens or Cutler Hammer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All panelboard dimensions and clearances shall be carefully checked and coordinated with the proper trades to insure proper mounting space and support prior to roughing in equipment. In no case shall any circuit breaker be located above 6’-7” A.F.F..

B. Wiring in panelboard wireways shall be done in a neat and workmanlike manner. Wiring shall be grouped into neat bundles and secured with approved tie wraps.

C. For all flush-mounted panelboards, a minimum of three (3) one-inch empty conduits shall be stubbed out above the nearest accessible ceiling space for future use.

3.2 PANEL IDENTIFICATION

A. Refer to Specification Section 26 05 53.

END OF SECTION 26 24 17

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Wiring Devices

B. Plates

C. Finishes

PART 2 - PRODUCTS

2.1 WIRING DEVICES AND PLATES

A. Switches shall be AC type, extra-heavy duty industrial grade (unless otherwise shown) of ratings shown on drawings. Switches shall be as manufactured by Hubbell, P & S, Sierra, Bryant, GE, Arrow Hart or equal.

B. Receptacles shall have blade configuration and shall be heavy duty industrial grade (unless otherwise shown) of current and voltage rating as shown on drawings. Receptacles shall be as manufactured by Hubbell, P & S, Sierra, Bryant, GE, Arrow Hart or equal.

C. All GFCI-type receptacles shall continuously self-test and shall trip/deny power if the receptacle does not provide proper GFCI protection or if the line/load terminations are miswired and shall provide visual indication of power status, trip conditions, ground fault conditions and end-of-life status.

D. Each wiring device shall have a plate (see “Finishes” section below for specific requirements).

2.2 FINISHES

A. All wiring devices (switches, receptacles, etc.) shall be colored to match the coverplates described below. For instance, all items covered by stainless steel, aluminum or malleable iron plates shall be gray in color.
   1. Exceptions:
      a. Emergency wiring devices shall be red.
      b. Isolated ground wiring devices shall be orange.

B. Coverplates for recessed, wall-mounted electrical items (switches, receptacles, telephone outlets, etc.) shall be stainless steel unless shown otherwise.

C. Coverplates, trim rings, etc. for recessed, floor-mounted electrical items (floor outlets, underfloor duct junctions, etc.) shall match finish of building hardware (302/304 stainless steel, brass, etc.) in area installed.

D. Coverplates for exposed electrical items (switches, receptacles, telephone outlets, etc.) shall be

of same material as exposed boxes (see Outlet Box Specification for required material type) and shall have beveled edges.

E. Coverplates for receptacles in wet locations shall be metallic, in-use type, rated for wet locations per NEC requirements unless noted otherwise.

F. See “Electrical Identification” specification section for coverplate labeling requirements.

PART 3 - EXECUTION

3.1 GENERAL MOUNTING

A. Symbols on drawings and mounting heights are approximate. The exact locations and mounting heights shall be determined on the job, and it shall be the Contractor's responsibility to coordinate with all trades to secure correct installation. For example, Contractor shall coordinate exact mounting heights over counters, in or above backsplashes, in block walls, and at other specific construction features.

B. Verify all door swings with Architectural. Locate boxes for light switches within four inches of door trim on swing side (not hinge side) of door.

C. Devices and associated plates shall not be used as support; outlet boxes shall be rigidly supported from structural members.

D. Mount all straight-blade receptacles vertically with ground pole up, unless specifically noted otherwise.

E. Unless otherwise shown or required by local handicap codes, outlet boxes shall be the following distances above the finished floor unless otherwise noted.
1. Receptacles and telephone outlets in offices and other finished areas: 1’-6” to the center of the box.
2. Receptacles and telephone outlets in equipment rooms and other unfinished areas: 4’-0” to the center of the box.
3. Receptacles over counters: As Noted
4. Switches, general: 4’-0” to the top of the box.
5. Fire Alarm Pull Stations: 4’-0” to the top of the box.
6. Fire Alarm Audio/Visual Devices: As shown on fire alarm shop drawings (Entire lens shall be above 80” and below 96” per NFPA 72).
7. Push-button, etc., general: 4’-0” to the top of the box.
8. Other device types: verify with engineer prior to rough-in.

END OF SECTION 26 27 26

SECTION 26 28 16

SAFETY SWITCHES AND FUSES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Safety Switches

B. Fuses

C. Branch Feeders

D. Feeders

PART 2 - PRODUCTS

2.1 SAFETY SWITCHES

A. Safety switches shall be quick-make, quick-break, NEMA heavy duty type HD, fused or nonfused as shown. Switch blades shall be fully visible in the off position.

B. Safety switches shall be furnished with transparent internal barrier kits to prevent accidental contact with live parts. Barriers shall provide finger-safe protection when the switch door is open and shall allow use of test probes and removal of fuses without removing barrier.

C. Fused switches shall have provisions for class R, rejection type fuses.

2.2 FUSES (600V)

A. Fuses for all branch switches shall be Bussman Mfg. Co., Dual Element, Class “R” Fusetron.

B. Fuses for main switch/switches shall be Bussman Mfg. Co. Hi-Cap.

2.3 MANUFACTURER

A. Safety switches shall be as manufactured by Square 'D', G.E., Siemens or Cutler Hammer.

B. Fuses shall be as manufactured by Bussman Mfg. Co. or equal.

PART 3 - EXECUTION

3.1 SAFETY SWITCHES

A. Safety switches shall be installed as shown on the plans and in accordance with N.E.C.

B. Locations shown for safety switches on plans are diagrammatical only. Exact locations shall be field coordinated by contractor as required to provide code-required clearances.

C. Switch enclosures shall be rated NEMA I indoors in dry locations and NEMA3R outdoors and

in wet areas.

D. Adequate support shall be provided for mounting safety switches. Safety switches shall not be mounted to the associated equipment (unless the safety switch is furnished with the equipment).

3.2 FUSES

A. Fuses shall be sized as shown on drawings, unless a smaller size is required by the associated equipment supplier, in which case the contractor shall provide fuses sized as directed by the associated equipment supplier at no additional cost.

B. Provide not less than one spare set of fuses for each size used. Provide an additional spare set for each five sets of same size fuses used.

END OF SECTION 26 28 16

SECTION 26 41 00

LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Furnish and install all materials and labor required to provide a complete and functional Lightning Protection and Common Grounding System as indicated, in strict accordance with this section of the Specifications and the applicable Contract Drawings.

1.2 STANDARDS & QUALITY ASSURANCE

A. The lightning protection system shall comply with all requirements of the latest edition of each of the following codes and standards. The latest edition of these codes and standards form a part of this specification:
1. U.L. Standard 96A.
2. Lightning Protection Institute - Installation Code LPI-175.
3. N.F.P.A. 780.

B. Equipment manufacturer shall be certified by the Lightning Protection Institute, and products approved for UL listing. All materials shall be manufactured by one of the following manufacturers:
1. Bonded Lightning Protection Systems
2. East Coast Lightning Protection
3. Erico/Eritech Lightning Protection
4. Harger Lightning Protection
5. Preferred Lightning Protection
6. Robbins Lightning
7. Thompson Lightning Protection

C. For approval of LPI manufacturer other than specified, complete proposed material data and installation drawings shall be submitted to Engineer for review not less than 10 days prior to bid date.

D. In order to insure integrity of installation, the system shall be installed under the direct jobsite supervision of a Certified Master Installer/Designer, who has qualified under the LPI's Certification Program as a Master Installer/Designer.

1.3 SUBMITTALS

A. Complete shop drawings of the entire lightning protection system showing the type, size, mounting details, and location of all equipment, grounds, cable routings, roof materials (for coordination of lightning protection system materials), etc., shall be submitted to the Architect-Engineer for approval prior to start of work.

B. Submittals shall document the local manufacturer’s representative’s Certified Master Installer/Designer qualifications from LPI.

PART 2 - PRODUCTS

2.1 SYSTEM

A. System materials in general shall be copper, copper alloy or aluminum with high-copper content bronze castings or aluminum castings (all compatible with associated surface materials and installed per UL, NFPA & LPI standards), and shall comply in weight, size and composition for the class of structure to be protected. The system shall consist of all necessary cables, air terminals, mounting bases, fittings, couplings, connectors, fasteners, surge protection devices, etc., as required to give a complete and coordinated system.

B. Copper conductors shall be utilized for all downleads and below-grade conductors.

C. Aluminum components shall be utilized in cases where copper is not compatible with mounting surfaces.

D. All ground rods shall be copper-clad steel.

E. All cable and all air terminals shall bear proper UL labels.

F. Air terminals shall have blunt tips.

G. System design shall be concealed wherever practical, with roof perimeter cables concealed in parapet walls, and mid-roof cables installed under roof slabs. Exposed cable on parapet walls will only be accepted if structural details preclude cable concealment. Cable drops for roof penetrations at downlead locations shall be made with solid-bar thru-roof connectors, with copper rod flashings. Bond rebars top and bottom at each downlead position and risers. Primary and secondary bonding of roof metals and equipment shall also be under roof slabs. Ground level, intermediate and roof level potential equalization shall be provided per current building Code classifications.

H. All system fittings except cable holders, regardless of Structure classification, shall be heavy-duty type made from bronze or aluminum castings and secured with bolted-pressure clamps. Pressure plates made from stamped or pressed metal parts, or fittings utilizing crimp-type pressure devices will not be allowed. All bolts, screws, and related type hardware shall be stainless steel.

I. Contractor shall coordinate with the roofing contractor to insure compatibility of any adhesive with the roofing system in use.

J. Cable fasteners shall be substantial in construction, electrolytically compatible with the conductor and mounting surface, and shall be spaced according to LPI, UL, and NFPA code requirements.

K. Where applicable, an approved bimetal transition fitting shall be used at the roof level to change from aluminum roof conductor to copper downlead cable.

L. Surge protection devices shall be provided on the power, telecommunications and other conductive electrical services at the points of entrance into the building(s) as required by UL96A in order to obtain the UL Master Label Certificate of Inspection. It shall be the responsibility of the electrical contractor to install or verify that a proper surge protection device has been installed on the each of the building electrical services to meet this requirement. This

may require surge protection devices in addition to those specifically shown on plans or called out within other specifications.

PART 3 - EXECUTION

3.1 SUPERVISION AND CERTIFICATION

A. The manufacturer's local representative shall be a Certified Master Installer/Designer under the LPI program, and shall provide direct jobsite technical supervision to Contractor's personnel during installation to insure compliance with all Code requirements. Upon job completion, Contractors shall furnish Owners with written certification on UL Master Label "C",that system is installed in compliance with above Standards.

END OF SECTION 26 41 00

SECTION 26 43 00

SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (<1000 V) power distribution and control equipment.

B. The specified unit(s) shall provide effective high energy transient voltage surge suppression, surge current diversion and high frequency noise attenuation in all electrical modes for equipment connected downstream from the facility's meter or load side of the main overcurrent device. The unit(s) shall be connected in parallel with the facility's wiring system.

C. The unit(s) shall be designed and manufactured in North America by a qualified manufacturer of suppression filter system equipment. The qualified manufacturer shall have been engaged in the commercial design and manufacturer of such products for minimum of ten (10) years.

D. All products that are submitted according to these specification will be required to meet this specification in it's entirety for both service and distribution TVSS systems. Any product that is submitted and does not comply with all parts of this specification will be subject to rejection.

1.3 DEFINITIONS

A. VPR: Voltage Protection Rating.

B. SPD: Surge Protective Device(s)

C. $I_{(n)}$: Nominal Discharge Current

1.4 SUBMITTALS

A. See specification section 26 05 00.

B. Product Data: For each type of product indicated. Include:
1. Maximum Single Impulse Surge Current Rating.
2. Surge Life (Repetitive Surge) Rating.
3. UL1449 (Latest Edition) Voltage Protection Ratings (VPR).
4. UL1449 (Latest Edition) Nominal Discharge Current (In).
5. Product dimensions and weights.
6. Furnished specialties and accessories.

C. Qualification Data:

D. Safety Agency File Number.

E. ISO 9001-2008 Certification.

F. ISO 1401-2001 Certification.

G. Operation and Maintenance Data: For SPDs to include all submittal data and any applicable operation and maintenance manuals.

H. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.

B. The unit shall be UL 1449 Listed and CUL Approved as a Surge Protective Device and UL 1283 Listed as an Electromagnetic Interference Filter

C. Provide 2nd party certified data demonstrating SPD response to ANSI/IEEE C62.41.2-2002 standard waveforms when tested according to IEEE C62.45.

D. Comply with NFPA 70.

E. All SPDs provided within this project at the service entrance, distribution panels, and sub-panels shall be from the same manufacturer.

1.6 PROJECT CONDITIONS

A. Service Conditions: Rate SPDs for continuous operation under the following conditions unless otherwise indicated:
1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
2. Operating Temperature: 30 to 150 deg F.
3. Humidity: 0 to 95 percent, non-condensing.
4. Altitude: Less than 13,000 feet above sea level.

1.7 COORDINATION

A. Where field-mounted SPD's are specifically shown on plans, coordinate locations of field-mounted SPDs to allow adequate clearances for maintenance.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.
1. Warranty Period: 10 years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective

covering for storage and identified with labels describing contents.

1. Replaceable Protection Modules: 1 of each size and type installed, where field-replaceable modular SPDs are provided.
2. Fuses: 1 of each size and type installed, where field-replaceable fuses are provided.

PART 2 - PRODUCTS

2.1 SURGE PROTECTIVE DEVICES

A. Manufacturer:

1. Integral Devices: Surge Protective Devices shall be as manufactured by the distribution equipment manufacturer (Square D, etc.), or by Surge Suppression Inc. if all of the performance of this specification are met and all UL listing of the equipment manufacturer are met.
2. External Devices (where specifically specified on plans): Surge Protective Devices shall be as manufactured by the distribution equipment manufacturer (Square D, etc.) or Surge Suppression Inc.

B. Each Surge Protective Device shall:

1. Be internal to the associated distribution equipment (without violating any applicable UL listings) unless specifically shown otherwise on plans.
2. Be UL 1449 (Latest Edition) listed.
3. Have short-circuit current rating complying with UL 1449 (Latest Edition), that matches or exceeds the short-circuit rating of the associated distribution equipment.
4. Be designed to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS voltage.
5. Have fuses, rated at 200-kA interrupting capacity.
6. Have a minimum UL 1449 Nominal Discharge Current (I_n) Rating of 20kA.
7. Be fabricated using bolted compression lugs.
8. Provide suppression for all ten (10) modes of protection.
9. Have LED indicator lights for power and protection status of each phase.
10. Have audible alarm, with silencing switch, to indicate when protection has failed.
11. Have form-C contacts rated at 2 A and 24-V ac minimum, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with facility monitoring and control system if monitoring by that system is required by plans or other specifications.
12. Have six-digit transient-event counter, mounted to front of equipment door, set to totalize transient surges (externally mounted SPD's may have the transient –event counter monted on the visible face of the SPD).
13. Meet all UL 96A requirements (for Lightning Protection Systems) where the device is installed at a service entrance of the facility. At a minimum, these devices shall:
    a. Be marked as Type 1 or Type 2 SPDs with product Identity consisting of "Surge Protective Device" or "SPD", and identifying all ratings so required by UL96A and the 4 digit alpha numeric Control Number.
    b. Have a minimum UL 1449 Nominal Discharge Current (I_n) Rating of 20kA.
    c. Be UL listed and labeled with holographic label.

C. Peak Single-Impulse Surge Current Rating shall be meet the following minimums unless

specifically shown otherwise on plans:

Application	Per Phase	Per Mode
Service Entrance Devices	240 kA	120 kA
Downstream Devices	160 kA	80 kA

D. The ANSI/UL 1449 voltage protection rating (VPR) in grounded wye circuits, the SPDs shall not exceed the following:

Modes	208Y/120V	480Y/277V	600Y/347V
L-N,L-G, N-G	800	1200	1500
L-L	1200	2000	2500

E. The ANSI /UL 1449 VPR for 240/120 V, 3-wire or 4-wire circuits with high leg shall not exceed the following:

Modes	240/120V
L-N,L-G, N-G	1200/800

2.2 ENCLOSURES

A. Where external units are specifically specified on plans, units not mounted within electrical distribution equipment (such as switchboards, MCC's, etc.) shall be provided in enclosures with NEMA enclosure ratings that match or exceed the NEMA enclosure ratings of the equipment from which the units are fed. For example, a unit fed from a NEMA 4X stainless steel panelboard shall also be mounted within a NEMA 4X stainless steel enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All SPD's shall be integrally-mounted within the associated distribution equipment unless specifically shown otherwise on plans.

B. Install SPDs at service entrance on load side, with ground lead bonded to service entrance ground.

C. Install SPDs downstream of the service entrance with conductors or buses between suppressor and points of attachment as short and straight as possible. The lead lengths between the TVSS unit and the equipment being protected shall not exceed fourteen (14) inches without approval from the engineer. Do not bond neutral and ground. Leads shall be as straight as possible with no sharp bends.

D. Where externally-mounted SPD's are specifically shown on plans, provide circuit breaker as

directed by the SPD supplier as a dedicated disconnecting means for SPD unless otherwise indicated.

3.2 FIELD QUALITY CONTROL

A. Ensure that interiors are free of foreign materials and dirt.

B. Check and test switches, pushbuttons, meters for proper operation.

C. Check and test indicating lights for proper operation and color.

D. Perform manufacturer's on site field test procedures.

3.3 STARTUP SERVICE

A. Do not perform insulation resistance (MEGGER) tests of the distribution wiring equipment with the SPDs installed. Disconnect all wires, including neutral, before conducting insulation resistance tests, and reconnect immediately after the testing is over.

3.4 SYSTEM WARRANTY

A. The SPD system manufacturer shall warranty the entire SPD system against defective materials and workmanship for a period of ten (10) years from the date of substantial completion. This warranty is in effect as long as the unit is installed in compliance with the manufacturer's installation, operation, and maintenance manual, UL Listing requirements, and any applicable national or local electrical codes.

B. Any SPD device which shows evidence of failure or incorrect operation, including damage as the result of lightning strikes, during the warranty period shall be replaced by the manufacturer at no charge to the owner. Warranty will provide for multiple exchanges of any inoperable devices at any time during the warranty period which starts at the date of substantial completion of the system to which the surge suppressor is installed.

C. The manufacturer is required to have a nationwide network of factory-authorized local service representatives for repair and service of this product. The manufacturer shall have a dedicated 1-800 telephone number for service problems and questions. This number shall be manned by a knowledgeable factory employee to ensure prompt response to any emergency situation that may arise.

END OF SECTION 26 43 00

SECTION 26 50 00

LIGHTING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Lighting Fixtures

B. Drivers

1.2 SUBMITTALS

A. Complete submittals shall be provided identifying all lighting fixture types and options, all lamp types (where applicable) and compliance with all contract requirements. The absence of clear submittal information specifically listing exceptions/deviations from detailed contract requirements will be understood to indicated that the contractor/supplier intends to meet all contract requirements. Refer to specification section 26 05 00 for additional requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Lighting fixtures shall be furnished as shown on plans and specified herein. It shall specifically be the responsibility of Contractor to verify exact types ceilings, walls, etc. and recessing depth of all recessed fixtures and furnish the specific mounting trims and accessories of the specified and/or accepted fixture specifically for the ceiling, wall etc. in which each fixture is to be installed.

B. Base bid manufacturers are listed on the lighting fixture schedule. Manufacturers listed without accompanying catalog numbers are responsible for meeting the quality standards, efficiency, maximum wattages and photometric distributions set by the specified product.

C. All lighting fixtures shall be so designed and shall have drivers and other similar items so installed as to function without interruptions or failures when operating in the environment in which they are proposed to be installed. Special attention shall be given to environments with potentially high ambient temperatures such as attic spaces, exterior soffits, confined interior soffits, coves, unconditioned spaces, etc. and shall be addressed by providing fixtures with suitable high ambient temperature ratings, remote mounting of drivers/ballasts, providing approved ventilation, etc. as directed by fixture manufacturer and approved by engineer, at contractor’s expense.

D. All fixtures installed such as to create penetrations through fire rated ceiling or wall assemblies shall be labeled as suitable for that purpose or installed with covers, tenting or other means as required to maintain the fire rating of the assembly.

2.2 LED LUMINAIRES

A. For the purpose of these specifications, LED Luminaires shall be defined as the entire LED fixture assembly including LED array, drivers, housing, electronics, etc. that compose the

lighting fixture.

B. Furnish and install LED Luminaire of proper size, type, efficacy, delivered lumen output, color temperature, distribution pattern, operational life, and CRI as shown on drawings.

C. LED Luminaires shall be tested in accordance with LM-79 and LM-80 standards.

D. LED drivers shall comply with NEMA 410 standards for inrush current, etc.

E. Exterior, pole mounted LED Luminaires shall be provided with an easily-serviceable, UL recognized surge protection device that meets a minimum 10kA Category C Low operation (IECC C62.41.2-2002). Device shall be wired in front of light engine(s) and driver(s) and shall fail "open" such as to prevent fixture operation after a surge protection failure.

F. LED Luminaires shall have a guarantee-warranty of at least five years unless specifically noted otherwise on contract documents.

G. LED Luminaire assembly shall comply with ambient temperature requirements specified in General section above.

2.3 STEMS/PENDANTS

A. Hangers shall be approved ball aligner type swivel, 30 degrees from vertical with swivel below canopy.

B. Stems/Pendants shall be rigid or IMC conduit unless specified otherwise on plans. Proposed stem/pendant types shall be submitted for review prior to shipment of light fixtures from factory.

C. Stems/Pendants shall be provided as required to prevent swaying of fixtures due to HVAC system airflow or other similar occurrences.

D. Shall be painted the same color as the fixture trim unless noted otherwise.

2.4 MANUFACTURER

A. Fixtures and stems shall be manufactured as shown in fixture schedule or approved equals.

B. Drivers shall be as manufactured by Philips/Advance, GE, Lutron, Magnatec, Motorola, EldoLED or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF LIGHTING FIXTURES

A. Support:
1. Support of all lighting fixtures shall be responsibility of electrical contractor. All lighting fixture supports shall be installed in accordance with lighting fixture supplier's recommendations.
2. Contractor shall coordinate installation requirements for all wall-mounted fixtures (especially for wall-mounted fixtures on uneven wall surfaces, etc.) as required to assure a

level/flat mounting surface and level/plumb/secure finished installation. Contractor shall provide flat mounting plates or other mounting provisions where necessary. Any proposed mounting plates, etc. shall be submitted to and approved by project architect prior to ordering materials.

3. Fixtures shall be supported independent of ceiling from structural members of building.
4. Lay-in fixtures shall be supported by four (4) taut 12 gauge hanger wires connected from each corner of the fixture to the structure above so that fixture is supported independent of the ceiling.
5. Other recessed light fixtures (including recessed downlights) shall be supported with two (2) taut 12 gauge hanger wires connected from opposing corners of the light fixture to the structure above so that fixture is supported independent of the ceiling.
6. Pendant mounted fixtures shall be directly supported from the structure above using a 9 gauge hanger wire or an approved alternate support without using the ceiling suspension system for direct support.
7. Tandem fixtures may utilize common hanger wires.
8. All lay-in fixtures shall be attached to ceiling grid by means of approved clips and in accordance with the N.E.C.
9. Contractor shall submit typical hanging detail to Engineer before installing any fixtures.

B. Connections:
1. All grid fixtures shall be wired by flex individually to junction and not wired fixture to fixture.
2. All flex shall contain 3 conductors (3rd wire ground). Ground wire shall be securely grounded at each end. Other conductors shall be connected by approved connectors.

C. Row-Mounted fixtures:
1. All stems on row-mounted fluorescent fixtures shall be installed as follows (except fixtures with slide grip hangers):
   a. One stem shall be installed in the first fixture knockout from end of row (on the first and last fixture of the row).
   b. One stem shall be installed between each two fixtures. Stem shall center joint where fixtures join and shall attach by use of “joining plates”.
2. All fixtures in continuous rows other than recessed grid type shall be connected by nipples with locknuts bushings.

D. Coordination:
1. Contractor shall coordinate all dimensions & locations of light fixtures prior to rough-in to insure proper fit and coordination with other trades.
2. Contractor shall verify exact ceiling types being installed and shall adjust fixture trim types accordingly (prior to submitting light fixture shop drawings).

END OF SECTION 26 50 00

SECTION 27 05 00

AUXILIARY SYSTEM CABLES, 0-50V

PART 1 - GENERAL

1.1 DESCRIPTION

A. Cables rated for 0V-50V application

PART 2 - PRODUCTS

2.1 GENERAL

A. Unless specified otherwise, all cables within the scope of this specification section shall:
1. Be rated for exposed cable tray installation.
2. Be plenum rated.
3. Be UL-rated for the proposed application.
4. Be multi-conductor with overall outer sheath as required by the application. The insulation of each conductor within the overall multi-conductor cable shall be uniquely color-coded. Ground conductors (when provided) within the multi-conductor cable shall have green insulation. Conductors with green insulation shall not be used for conductors other than ground.
5. Utilize copper conductors.
6. Have wire gauge as required to limit voltage drop to acceptable limits determined by the system supplier and to meet all applicable code requirements.
7. Where installed underground, within slab-on-grade or in exterior locations, be rated for wet locations.
8. Where required for specific systems, meet the specific requirements (conductor quantity, wire gauge, insulation type, shielding, etc.) of the system supplier.

2.2 CLASS 1 CONTROL CABLING (120VAC CONTROL CIRCUITS, ETC.)

A. In addition to above requirements, and unless specified otherwise, Class 1 control cabling shall:
1. Be rated for 600V.
2. Be industrial grade.
3. Have stranded conductors.
4. Have sunlight/oil-resistant PVC/Nylon insulation and jacket with ripcord.
5. Be manufactured by Belden, AlphaWire or General Cable.

2.3 CLASS 2 & 3 CONTROL CABLING (FED FROM CLASS 2 OR 3 POWER SUPPLIES)

A. In addition to above requirements, and unless specified otherwise, Class 2 & 3 control cabling shall:
1. Be rated for 300V.
2. Be shielded if so recommended by the system supplier/integrator.
3. Have twisted conductors.
4. Have plenum-rated insulation/jacket with ripcord.
5. Be manufactured by AlphaWire, Belden, General Cable, Superior Essex or West Penn.

2.4 NETWORK CABLING

A. Furnish and install all Ethernet, Fiber Optic and Backbone Copper Telephone cabling in accordance with all BICSI requirements and in accordance with other applicable specification sections.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Routing:
1. All wires and cables shall be installed in conduit unless specifically noted otherwise. Where conduit is not otherwise required by contract documents, 0-50V Cabling located within concealed, accessible ceiling spaces (such as above lay-in ceilings) may be run without conduit if the following requirements are met:
   a. Cabling is plenum-rated, multi-conductor.
   b. Cabling is supported by cable tray or with J-hook supports on intervals not to exceed 5'-0" on center. Cabling shall be supported solely from the cable tray or j-hooks supported from the building structure, without using piping, ductwork, conduit or other items as supports.
   c. Cabling is neatly formed, bundled and tied with plenum-rated Velcro straps on intervals not to exceed 30" on center.
   d. Properly-sized conduit(s) are provided wherever cabling enters an inaccessible or exposed area (such as above gyp board ceilings, within walls or through walls).
   e. Cabling is not a part of a Fire Alarm System, Smoke Control System, Emergency Generator Control System or other life-safety related system.
2. End bushings shall be provided on both ends of all raceway terminations.
3. No splices shall be pulled into conduit.
4. No cabling shall be pulled until conduit is cleaned of all foreign matter.

B. Penetrations:
1. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly.
2. For cabling not installed in conduit:
   a. Fire/smoke barrier penetrations shall be sealed utilizing an enclosed fire-rated pathway device (STI EZ Path or equal) containing a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed or retrofitted without the need to remove or reinstall firestop materials. The pathway shall be UL Classified and tested to the requirements of applicable ASTM/UL1479 standards.
3. For cabling installed within conduit from endpoint to endpoint:
   a. Fire/smoke barrier penetrations shall sealed utilizing fire caulk or other equivalent firestop systems around perimeters of conduits per UL requirements.
4. For cabling installed within cable trays:
   a. Fire/smoke barrier penetrations shall be sealed with one of the following methods:
      1) Continuous cable tray through the penetration, with a combination of large firestop pillows and small firestop pillows contained, supported and secured (to prevent unauthorized removal) on both sides by aluminum wire mesh and firestop putty. Firestop pillows shall be STI Series SSB or equal and Firestop putty shall be STI Spec Seal or equal.

2) Cable tray broken at the penetration, with fire/smoke barrier penetrations sealed utilizing an enclosed fire-rated pathway device (STI EZ Path or equal) containing a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed or retrofitted without the need to remove or reinstall firestop materials. The pathway shall be UL Classified and tested to the requirements of applicable ASTM/UL1479 standards.

C. Excess Cabling:
1. Excess cabling shall be neatly coiled within all junction boxes, pullboxes, wireways, etc. and at all terminations as required to allow future re-termination of cabling.

D. Terminations:
1. All conductors/cabling (including spare conductors) shall be properly terminated unless specifically directed otherwise. See below for general termination hardware requirements.
2. Cabling shall be neatly formed, bundled and tied at all terminations.

3.2 SPLICES/CONNECTIONS/TERMINATIONS:

A. Network Cabling:
1. Network and fiber optic cabling shall be continuous from endpoint to endpoint and shall not be spliced unless specifically noted otherwise.

B. Control Cabling:
1. Connections shall be made with T & B Sta-Kon wire joints EPT66M, complete with insulating caps. To be installed with WT161 Tool or C nest of WT11M Tool, Ideal Super - Nuts (not wire nuts), Ideal Wing Nuts, or Buchanan Elec. Products B Cap or Series 2000 Pressure connectors complete with nylon snap on insulators to be installed with C24 pressure tool.

C. Shielded cabling:
1. Unless directed otherwise by the system supplier, 0-50V cable shielding shall be grounded at the PLC/control panel end only (not at the field device end) with a termination kit as directed by the PLC/control panel supplier.
2. Shielded cabling shall be continuous from endpoint to endpoint and shall not be spliced without prior written approval from the Engineer.

3.3 LABELING

A. Refer to Specification Section 26 05 53 for all labeling requirements.

END OF SECTION 27 05 00

SECTION 27 10 00

STRUCTURED CABLING SYSTEM

PART 1 - GENERAL

1.1 SCOPE:

A. This document describes the products and execution requirements relating to furnishing and installing Telecommunications Cabling. Backbone and Horizontal cabling comprised of copper and fiber cabling, and support systems are covered under this document.

B. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the structured cabling contractor as detailed in this document.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types are indicated on the plans. If the bid documents are in conflict, this specification shall take precedence.

D. Refer to Specification Section 26 05 53 (Electrical Identification) for additional identification requirements.

E. Refer to Specification Section 27 05 00 (Auxiliary System Cables, 0-50V) for additional material and installation requirements.

1.2 REGULATORY REFERENCES:

A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the National Electrical Code, local ordinances and present manufacturing standards.

B. All materials shall be UL Listed and shall be marked as such. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

C. All modular jacks, patch cords, consolidation point, and patch cords shall be ETL Verified (not just tested) to be category 6 component and channel compliant.

D. The cabling system described in this specification is derived from the recommendations made in recognized telecommunications industry standards. The following documents are incorporated by reference:
1. ANSI/TIA/EIA - 568-B.1, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements, April, 2001
2. ANSI/TIA/EIA - 568-B.2, Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components, April, 2001

3. ANSI/TIA/EIA - 568-B.2-1, Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted Pair Cabling Components, Addendum 1 – Transmission Performance Specifications for 4-pair 100 Ω Category 6 Cabling
4. ANSI/TIA/EIA - 568-B.3, Commercial Building Telecommunications Cabling Standard Part 3: Optical Fiber Cabling Components, March, 2000
5. ANSI/TIA/EIA – 569-A, Commercial Building Standard for Telecommunications Pathways and Spaces, February, 1998
6. ANSI/TIA/EIA – 606-A, Administration Standard for Telecommunications Infrastructure of Commercial Buildings, February, 2002
7. ANSI/TIA/EIA – 607-AJ, Commercial Building Grounding and Bonding Requirements for Telecommunications, August 1994
8. ANSI/ TIA/EIA – 758, Customer-Owned Outside Plant Telecommunications Cabling Standard, April 1999
9. BICSI - TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM) 10TH edition.
10. National Fire Protection Agency (NFPA – 70), National Electrical Code (NEC) –2002
11. ANSI/TIA/EIA – 45-B, Test Procedures for Fiber Optic Connections.
12. ANSI/TIA/EIA – 526-14, Power Test for Fiber Runs.
13. FCC 47 CFR 68
14. NEMA 250
15. NEC Articles 770 and 800
16. ADA, Americans with Disabilities Act

E. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release.

F. This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project. All local State and federal codes are to be followed.

1.3 APPROVED CONTRACTOR:

A. The Structured Cabling Contractor must meet the following requirements:
1. Contractor must have a certified RCDD on staff. The project manager for this project shall have an RCDD certification, and RCDD shall be responsible for reviewing all aspects of the design, submittals and installation of all products.
2. All required submittal information shall be stamped by the RCDD.
3. Contractor must have a minimum of 3 years experience with projects of similar size and scope to this project.
4. The company performing the work must have been in business for a minimum of 3 years.
5. The company must have an office within 75 miles of the job site.

B. The Structured cabling contractor is responsible for workmanship and installation practices in accordance with the requirements of the standards described in these specifications and manufacturer's requirements.

1.4 WORK INCLUDED:

A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations necessary to complete the installation of this structured cabling system in compliance with the specifications and drawings. The structured cabling contractor will provide and install all of the required material to form a complete system whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:
1. Furnish and install a complete telecommunications wiring infrastructure.
2. Furnish, install, and terminate all UTP and Optical Fiber cable
3. Furnish and install all wall plates, jacks, patch panels, and patch cords at equipment racks and at work outlets (unless shown otherwise on plans).
4. Furnish and install all required cabinets and/or racks as required and as indicated.
5. Furnish any other material required to form a complete system.
6. Perform channel testing (100% of horizontal and/or backbone links/channels) and certification of all components.
7. Furnish test results of all cabling to the owner on disk and paper format, listed by each closet, then by workstation ID.
8. Provide owner test results and documentation. (Testing documentation and As-built drawings)

1.5 SUBMITTALS:

A. Within thirty (30) days of notice to proceed the structured cabling contractor shall submit the following items:
1. Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this spec.
2. Submit proof from manufacturer of contractor's good standing in manufacturer's certification program.
3. Submit copy of contractor's RCDD certification.
4. Submit listing of five (5) projects of similar size and scope to this project that have been completed within the last five years. Include in this submittal owner's contact information for each project.
5. Submit letter from the manufacturer stating that the manufacturer will provide a twenty-five year (25) warranty in accordance with the requirements paragraph 1.03 (B) of these specifications.
6. Submit appropriate cut sheets and samples for all products, hardware and cabling.
7. Submit 1/8" = 1'-0" drawings of floor plans indicating all work outlets and the labeling designation for each jack.
8. Submit ½" = 1'-0" drawings of each MDF and each IDF showing all racks, patch panels, 110 blocks, etc.

B. Work shall not proceed without the engineer's approval of the submitted items.

C. The structured cabling contractor shall receive approval from the engineer on all substitutions of material. No substituted materials shall be installed except by written approval from the engineer.

1.6 DRAWINGS:

A. It shall be understood that the electrical details and drawings provided with the specification package are diagrammatic. They are included to show the intent of the specifications and to aid the structured cabling contractor in bidding the job. The structured cabling contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications.

B. The structured cabling contractor shall verify all dimensions at the site and be responsible for their accuracy.

PART 2 - PRODUCTS

2.1 EQUIVALENT PRODUCTS:

A. Due to the nature and type of communications all products, including but not limited to faceplates, jacks, patch panels, racks, 110 blocks, and patch cords, for the purpose of this document, shall be manufactured by Hubbell, Ortronix, Panduit, Amp or Systimax. See below for acceptable cable manufacturers.

2.2 WORK AREA OUTLETS:

A. Work area cables shall each be terminated at their designated work area location in the connector types described in the subsections below. Included are modular telecommunication jacks. These connector assemblies shall snap into a faceplate.

B. The Telecommunications Outlet Assembly shall accommodate:
1. A minimum of two (2) modular jacks
2. Additional accommodations for specific locations as noted in the plans for optical fiber and/or additional copper cables as necessary
3. A blank filler will be installed when extra ports are not used.
4. A dust cap shall be provided on all modular jacks with the circuit number on the identifier strip.
5. Multiple jacks will be placed as documented on the plans.
6. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Prior to installation, the structured cabling contractor shall submit the proposed configuration for each outlet assembly for review by the architect.
7. The modular jack shall incorporate printed label strip on the dust cap module for identifying the outlet. Printed labels shall be permanent and compliant with ANSI/TIA/EIA-606-A standard specifications. Labels shall be printed using a printer such as a Brady hand held printer. Hand printed labels shall not be accepted.

C. Faceplates: The faceplates shall:
1. be UL listed and CSA certified.
2. be constructed of stainless steel (except where noted otherwise). All faceplate colors/materials in public areas shall be approved by the architect. In all cases the material and color of the faceplate shall match the adjacent electrical faceplate.
3. (where plastic faceplates are specifically allowed by the architect/engineer) shall match the faceplate color used for other utilities in the building or match the color of the raceway if installed in surface raceway.
4. be compliant with the above requirements along with the following when incorporating optical fiber:

a. be a low profile assembly,
b. incorporate a mechanism for storage of cable and fiber slack needed for termination,
c. position the fiber optic couplings to face downward or at a downward angle to prevent contamination and,
d. incorporate a shroud that protects the optical couplings from impact damage.

5. be available as single-gang or dual-gang.
6. possess recessed designation windows to facilitate labeling and identification.
7. shall include a clear plastic cover to protect labels in the designation window.
8. have mounting screws located under recessed designation windows.
9. comply with ANSI/TIA/EIA–606-A work area labeling standard.
10. allow for the UTP modules to be inverted in place for termination purposes.
11. be manufactured by an ISO 9001 registered company.

D. Voice / Data Jacks

1. Voice/Data jacks shall be 8-position modular jacks and shall be Category 6 performance as defined by the references in this document including ANSI/TIA/EIA-568-B.2-1. All pair combinations must be considered, with the worst-case measurement being the basis for compliance. Modular jack performance shall be third-party verified by a nationally recognized independent testing laboratory including, but not limited to, ETL.
2. The wiring scheme shall be T568A or T568B as directed by the owner.
3. The modular jack shall use dual reactance modular contact array.
4. The modular jack shall have low emission IDC contacts.
5. The modular jack shall use standard termination practice using 110 impact tool
6. The modular jack shall be backwards compatible to Category 3 and 5.
7. The modular jack shall be center tuned to category 6 test specifications.
8. Dust cover shall be used on each termination.

2.3 110 COPPER TERMINATION BLOCK:

A. The voice cross connect shall be a passive connection between the horizontal termination blocks and the backbone termination blocks. The wall mount frames shall be field terminated kits including all blocks, connecting blocks, and designation strips. Management rings shall be mounted between vertical columns of blocks to provide management of cross-connect wire. Backbone and horizontal blocks shall use 4-pair connecting blocks. Blocks shall be oriented so that backbone terminations are located on the left and horizontal frames are located on the right of the termination field when facing the frame assembly.

B. 110 Block Kits shall

1. include both the wiring block and connecting block in a 50, 100 and 300 pair footprint as required
2. be manufactured using fire retardant molded plastic.
3. include 4-pair 110C connecting blocks for field termination.
4. support termination of 22-24 AWG solid conductor
5. wiring blocks shall contain back openings for the feed through of cable
6. meet category 6 component compliance and be verified by a third-party nationally recognized independent testing laboratory
7. have color-coded tips on the wiring block and color coding on the connector blocks for installation identification.
8. shall use standard termination practice requiring a single conductor 110 impact tool

9. Termination hardware shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
10. be backwards compatible to category 3 and 5.
11. be labeled in compliance with ANSI/TIA/EIA-606-A labeling specifications using permanent labels and label printer.
12. be manufactured by an ISO 9001 registered company.

2.4 MODULAR PATCH PANELS:

A. The Modular Patch Panels shall
1. be modular design.
2. meet category 6 component compliance and be verified by a third-party nationally recognized independent testing laboratory
3. use low emission IDC contacts
4. use dual reactance technology to enhance the signal-to-noise ratio
5. require standard termination practices using a 110 impact tool
6. use a single piece IDC housing designed to accept larger Category 6 conductors
7. support both T568B and T568A wiring
8. include easy to follow wiring labels
9. include label fields
10. allow for the use of icons
11. include full length metal rear cable management
12. be available in standard or high density
13. be backward compatible to category 3 and 5.
14. be center tuned to category 6 test specifications
15. be sized to accommodate number of data or data and phone cables (where phone cables are terminated on patch panels in lieu of 110 blocks) served by each equipment room plus 30% spare capacity.
16. be separated by horizontal cable management sections.

2.5 RACKS:

A. The equipment rack shall provide vertical cable management and support for the patch cords at the front of the rack and wire management, support, and protection for the horizontal cables inside the legs of the rack.

B. Waterfall cable management shall be provided at the top of the rack for patch cords and for horizontal cables entering the rack channels for protection and to maintain proper bend radius and cable support. Double-sided wire management shall also be mounted above each patch panel and/or piece of equipment on the rack. The rack shall include mounting brackets for cable tray ladder rack to mount to the top of the rack. Velcro cable ties shall be provided inside the rack channels to support the horizontal cable. Rack shall be black in color to match the patch panels and cable management.

C. Free-Standing Racks shall:
1. have the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-B.
2. have top cable trough with waterfall and built in patch/horizontal cable distribution separator.

3. have horizontal front and rear cable management above, below and between each 48-port patch panel.
4. have a rack-mounted power strip.
5. have EIA hole pattern on front and rear.
6. be available with a 6.0" channel depth.
7. be available with hook and loop straps for securing bulk cables inside the vertical U-channels.
8. assemble as 19" (483 mm) or 23" (584 mm) with no additional hardware.
9. be available with three styles of vertical patch cord management: interbay with latches, cable management rings, or fingerduct with covers.
10. provide floor and ceiling access for cable management and distribution.
11. provide pre-drilled base for floor attachment of rack.
12. be available in standard color of black.
13. be manufactured by an ISO 9001 registered company.

D. Wall-Mounted Racks shall:
1. provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-B.
2. have top cable trough with waterfall and built in patch/horizontal cable distribution separator.
3. have horizontal front and rear cable management above, below and between each 48-port patch panel.
4. have a rack-mounted power strip.
5. have EIA hole pattern on front and rear.
6. be available with a 6.0" channel depth.
7. be available with hook and loop straps for securing bulk cables inside the vertical U-channels.
8. assemble as 19" (483 mm) or 23" (584 mm) with no additional hardware.
9. provide usable depth as required for standard network ethernet switch and other equipment
10. be available with three styles of vertical patch cord management: interbay with latches, cable management rings, or fingerduct with covers.
11. provide floor and ceiling access for cable management and distribution.
12. provide pre-drilled base for wall attachment of rack.
13. be available in standard color of black.
14. be manufactured by an ISO 9001 registered company.
15. be constructed to swing-out from wall (for rear access) via heavy-duty hinged corner and configurable for either left or right opening.

2.6 HORIZONTAL DISTRIBUTION CABLE:

A. Horizontal Distribution Cabling shall meet the following requirements:
1. Shall be 100 Ohm Enhanced Category 6 Unshielded Twisted Pair (UTP) Cable.
2. Physical Characteristics:
   a. Unless directed otherwise by owner (contractor shall verify with owner), Cat6 cable coloring shall be based on system type as follows, unless specifically approved otherwise:
      1) Data (or IP Voice): Blue
      2) Analog Voice: Grey
      3) Lighting Control System: White

4) Fire Alarm or other Life-Safety System: Red
5) CCTV Surveillance Cameras: Yellow
6) Other: As directed by owner

b. Shall be plenum-rated.
c. Shall meet applicable requirements of ANSI/ICEA S-80-576.
d. The diameter of the insulated conductor shall be .023 in. maximum.
e. Shall consist of (4) 22-26 AWG twisted pairs.
f. The overall diameter of the cable shall be no larger than 0.240 inches.
g. The ultimate breaking strength measured in accordance with ASTM D 4565 shall be 400 N minimum.
h. Cable shall withstand a bend radius of 1 inch at -20 degrees Celsius without jacket or insulation cracking.
i. Cable shall be third party verified to meet ANSI/TIA/EIA-568-B.2-1.
j. Where installed underground, within slab-on-grade or in exterior locations, be gel-filled and rated for wet locations.

3. Transmission Characteristics:
   a. DC resistance of any conductor shall not exceed 9.38 Ohms per 100m max. at 20° C. Measured in accordance with ASTM D 4566.
   b. The mutual capacitance of any pair at 1 kHz for 100m of cable shall not exceed 4.4 nF nominal.
   c. DC resistance unbalance any two conductors of any pair shall not exceed 5% when measured at or corrected to 20° C in accordance with ASTM D 4566.
   d. Structural return loss swept measurement for 100m or longer shall meet or exceed Category 6 requirements.
4. Shall be manufactured by Amp NetConnect, Berk-Tek, Leviton, General Cable, Mohawk or Superior Essex.

2.7 BACKBONE - FIBER:

A. Backbone Fiber Optic Cabling shall meet the following requirements:
   1. All optical fiber shall be Indoor/Outdoor,Tight-Buffered, All-Dielectric, Plenum rated (unless specified otherwise on plans) with Enhanced Multimode OM4-rated 50/125 Optical Fibers.
   2. Each Multimode Fiber shall:
      a. Be graded-index optical fiber wave-guide with nominal 50/125µm-core/cladding diameter.
      b. Comply with ANSI/EIA/TIA-492AAAC-A
      c. Have attenuation measured in accordance with ANSI/EIA/TIA-455-46, 53 or 61.
      d. Have information transmission capacity measured in accordance with ANSI/EIA/TIA-455-51 or 30.
      e. Have measurements performed at 23 degrees C +/- 5 degrees.
      f. Have Maximum attenuation dB/Km @ 850/1300 nm: 3.5/1.0
      g. Have bandwidth ≥ 4700 MHz-km @ 850nm. (EMB)
      h. Have bandwidth ≥ 500 MHz-km @ 1300nm.
      i. Be laser optimized and guarantee a 1 Gb/s distance of 1000 meters @ 850nm and 10 Gb/s at 600 meters @ 850nm.
      j. Terminate on fiber patch panel using SC Type fiber connectors.
   3. Each indoor/outdoor fiber optic cable shall:
      a. Be suitable for use in both outdoor and indoor applications without the use of a transition at the building entrance.
      b. Be suitable for use in risers, plenums and horizontal applications.

c. Have a dry water blocking system for cable.
d. Have a fiber strand count of 12 (unless shown otherwise on plans).
e. Have a nominal 2.21 mm sub-unit diameter.
f. Have and be marked with an UL-OFNP Flame Rating (unless engineer specified otherwise on plans).
g. Comply with Bellcore GR-409 and GR20
h. Be independently verified to comply with ICEA S-104-696
i. Have strength members of FGE/Aramid yarn.
j. Be suitable for underground or above ground conduits.
k. (Where applicable) Have Tight Buffered fibers color coded in accordance with EIA / TIA 598 with an overall black jacket.
l. Be suitable for operation between -40° to +70° C
m. Be UV resistant
n. Be of an all dielectric design

4. Shall be manufactured by Berk-Tek, Corning, General Cable or Superior Essex.

2.8 BACKBONE - COPPER:

A. Backbone Copper Cabling shall meet the following requirements:
1. Shall be Cat 3 rated.
2. Shall be RDUP PE-39 rated.
3. Where installed underground or in wet locations, shall include fully-flooded waterblocking compound to provide wet-location rating of cable.
4. Size of the backbone cables shall be determined by multiplying the number of horizontal voice cables to be terminated in each IDF by 200% and rounding up to the nearest 50 pair group. For Example if 94 horizontal voice cables are to be terminated in IDF1, install 94 x 1 pr x 200% = 188 pr rounded up to nearest 50 pr = 200 pr cable to IDF1.
5. Shall be manufactured by Berk-Tek, Corning, General Cable, Mohawk or Superior Essex.

2.9 COPPER CABLE SURGE PROTECTION DEVICES:

A. All copper circuits routed between or outside of buildings shall be provided with a surge protection device at each end. The surge protection device shall be labeled as meeting the requirements of the latest edition of UL 96A (exact requirements shall be coordinated with the lightning protection system supplier, where applicable).

B. The surge protection device shall be connected with a #6 AWG copper bonding conductor between the protector ground lug and the TC ground point.

2.10 PATCH CORDS:

A. The structured cabling contractor shall provide factory terminated and tested UTP and optical fiber patch cords and equipment cords for the complete cabling system. Patch cords shall be provided by the structured cabling contractor to connect patch panels to owner furnished electronics. The UTP patch cables shall meet the requirements of ANSI/TIA/EIA-568-B.2 and ANSI/TIA/EIA-568-B.2-1 for patch cord testing. Provide one set of optical fiber patch cables per fiber run that terminates on fiber patch panel and provide one category 6 patch cord for each category 6 work outlet that terminates on patch panel.

B. Copper (UTP) patch cords shall:
1. Be furnished to connect each patch panel jack to owner supplied electronics.

2. Be furnished for each work outlet jack.
3. Be a Category 6 patch cord manufactured by Panduit, Amp or Systimax.
4. Use 8 position connector with impedance matched contacts and designed using dual reactance.
5. Be constructed of 100 ohm, 4 pair, 24 AWG, stranded conductor, unshielded twisted pair copper per the requirements of the ANSI/TIA/EIA-568-B.2 and ANSI/TIA/EIA-568-B.2–1 standard.
6. Meet TIA category 6 component specifications in ANSI/TIA/EIA-568-B.2-1 100% factory tested to meet category 6 performance and ETL or any other nationally recognized 3rd party verification
7. Be capable of universal T568A or T568B wiring schemes.
8. Have modular connector that shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
9. Have a performance marking indelibly labeled on the jacket (by the manufacturer).
10. Have the ability to accept color-coded labels and icons to comply with ANSI/TIA/EIA-606-A labeling specifications.
11. Have "snagless" protection for the locking tab to prevent snagging and to protect locking tab in tight locations and provide bend relief
12. Be available in three standard colors
13. Be available in 3 foot, 5 foot, 7 foot, 10 foot, and 14 foot standard lengths
14. Be backwards compatible to Category 3, 5 and 5e

C. Fiber Optic patch cords shall:
1. Be furnished in the quantity of two (2) per IDF in each IDF and two (2) per IDF in each MDF.
2. Be manufactured by Panduit, Amp or Systimax.
3. Be multimode OM4 type.
4. Have connector type as directed by owner.
5. Have a performance marking indelibly labeled on the jacket (by the manufacturer).
6. Have the ability to accept color-coded labels and icons to comply with ANSI/TIA/EIA-606-A labeling specifications.
7. Be available in three standard colors
8. Be available in 3 foot, 5 foot, 7 foot, 10 foot, and 14 foot standard lengths

2.11 GROUNDING AND BONDING:

A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA/EIA-607 Telecommunications Bonding and Grounding Standard.

B. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a telecommunications ground bus bar (TGB). Each grounding bus shall be 12"W x 4"H x ¼"THK and be mounted to the backboard with porcelain isolators.

C. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of

green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

2.12 FIRESTOP:

A. A firestop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.

B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an UL listed firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.

2.13 INNERDUCT:

A. Innerduct, shall be:
1. Non-metallic, corrugated with pre-installed pull tape.
2. Plenum-rated, where installed within buildings.
3. UL listed for the application.
4. Size as required by the application.
5. Orange in color in concealed areas or within telecommunications or electrical rooms. Color shall be custom as selected by owner in exposed areas (such as within cable trays overhead in areas without ceilings outside telecommunications/electrical rooms).

PART 3 - EXECUTION

3.1 PRE-INSTALLATION SITE SURVEY:

A. Prior to start of work, meet at the project site with the owner's representative and representatives of trades performing related work to coordinate efforts. Review areas of potential interference and resolve conflicts before proceeding with the work. Facilitation with the General Contractor will be necessary to plan the crucial schedule completions of the equipment rooms and telecommunication closets.

B. Examine areas and conditions under which the system is to be installed. Do not proceed with work until satisfactory conditions have been achieved.

3.2 WORK AREA OUTLETS:

A. Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. No more than 12" of UTP and 36" of fiber slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B.1 document, manufacturer's recommendations and best industry

practices.

C. Pair untwist at the termination shall not exceed 12 mm (one-half inch).

D. Bend radius of the horizontal cable shall not be less than 4 times the outside diameter of the cable.

E. The cable jacket shall be maintained to within 25mm (one inch) of the termination point.

F. Data jacks, unless otherwise noted in drawings, shall be located in the bottom position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the right-most position(s).

G. Voice jacks shall occupy the top position(s) on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the left-most position(s).

3.3 HORIZONTAL DISTRIBUTION CABLE INSTALLATION:

A. All horizontal voice and data cabling shall be terminated on modular patch panels except for horizontal voice cables serving life safety related functions (fire alarm systems, security systems, elevator communications, etc.). All horizontal voice cabling serving life safety related functions shall be terminated on 110 blocks.

B. The voice and data cables shall be installed in separate patch panels.

C. All wiring above ceilings shall be installed in cable tray or open top cable hangers or in provided conduit.

D. Cable above accessible ceilings shall be supported 60” on center from cable support attached to building structure.

E. Do not untwist cable pairs more than 0.5 in. when terminating.

F. The Contractor shall be responsible for replacing all cables that do not pass Category 6 requirements for data and 5e for the voice applications.

G. Maximum horizontal cable length shall be 90 meters.

H. Cable shall have no physical defects such as cuts, tears or bulges in the outer jacket. Cables with defects shall be replaced.

I. Install cable in neat and workmanlike manner. Neatly bundle and tie all cable in closets. Leave sufficient cable for 90° sweeps at all vertical drops.

J. Do not install Category 6 cable with more than 110N (25 lbs) pull force, as specified in ANSI/TIA/EIA and BICSI TDDM practices. Utilize appropriate cable lubricant in sufficient quantity to reduce pulling friction to acceptable levels on long pulls inside conduit, pulls of multiple cables into a single small bore conduit, on conduit runs greater than 100 lineal feet with bends of opposing directions, and in conduit runs that exceed 180 degrees of accumulated bends. Use of tensile rated cords (i.e. fishing line) should be used for difficult or questionable

pulls - to judge to go/no-go condition of the conduit and pulling setup.

K. Cables jackets that are chaffed or burned exposing internal conductor insulation or have any bare copper (“shiners”) shall be replaced.

L. Test, label and document as called for in contract documents.

M. Firestop all openings where cable is installed through a fire barrier.

3.4 HORIZONTAL CROSS CONNECT INSTALLATION:

A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard, manufacturer's recommendations and best industry practices.

B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

D. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

E. The cable jacket shall be maintained as close as possible to the termination point.

F. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.5 OPTICAL FIBER TERMINATION HARDWARE:

A. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.

B. Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.

C. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.

D. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.

E. A maximum of 12 strands of fiber shall be spliced in each tray

F. All spare strands shall be installed into spare splice trays.

3.6 BACKBONE CABLE INSTALLATION:

A. Raceways:

1. All backbone cables shall be installed inside innerducts (see specification above) within conduits meeting specification requirements unless specifically noted otherwise.
2. Backbone cables shall be installed separately (in separate innerducts/conduits) from horizontal distribution cables.
3. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
4. Where backbone cables and distribution cables are specifically specified to be installed in a cable tray or wireway, backbone cables shall be installed first, within innerducts meeting specifications above, bundled separately from the horizontal distribution cables.

B. Support:
1. Within Telecommunications Rooms or at Telecommunications Backboards, all backbone cables shall be securely fastened to the backboards on the walls.
2. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
3. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
4. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

3.7 COPPER TERMINATION HARDWARE:

A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-A/B standard, manufacturer's recommendations and best industry practice.

B. Pair untwist at the termination shall not exceed 12 mm (one-half inch).

C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

D. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

E. The cable jacket shall be maintained to within 25 mm (one inch) of the termination point.

F. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.8 RACKS:

A. Floor-mount racks shall be used unless specifically shown otherwise.

B. Floor-mount racks shall be securely attached to the concrete floor using a minimum 3/8” hardware or as required by local codes.

C. Racks shall be placed with a minimum of 36 inches clearance from the walls on all sides of the rack. When mounted in a row, maintain a minimum of 36 inches from the wall behind and in front of the row of racks and from the wall at each end of the row.

D. All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 3.11 of this document.

E. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.

F. Wall mounted termination block fields shall be mounted on 4' x 8' x .75" void free plywood. The plywood shall be mounted vertically 12" above the finished floor. The plywood shall be painted with two coats of grey fire retardant paint.

G. Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame 18" from the finished floor.

H. Rack-mounted patch panels (and the associated horizontal cable management sections) furnished within the contract shall occupy no more than 40% of the available space within the associated racks (also furnished within the contract) unless specifically shown or specified otherwise. A minimum of 60% of available rack space shall be reserved for owner-furnished equipment. Where the number of patch panels and horizontal cable management sections would exceed 40% of the available rack space, an additional rack shall be installed.

3.9 EQUIPMENT TRAY FOR TELECOMMUNICATION ROOMS:

A. All equipment trays shall be 18" in width.

B. Furnish and install 18" equipment tray from each floor mount rack/server cabinet to wall. Furnish 18" equipment tray around wall as required to support cables. A minimum of two (2) walls shall be completely covered by equipment tray.

C. Furnish and install cable retaining posts on each side of tray every 4 feet as required to supports cables.

3.10 FIRESTOP SYSTEM:

A. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.11 GROUNDING SYSTEM:

A. The TMGB in the MDF shall be connected to the building electrical entrance grounding facility with a #6 AWG ground. Each TBB in each IDF shall be connected to a ground bus in the MDF with #4/0 AWG minimum ground. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

B. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the TR or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.

C. The TBB shall adhere to the recommendations of the ANSI/TIA/EIA-607 standard, and shall be installed in accordance with best industry practice.

D. Installation and termination of the main bonding conductor to the building service entrance ground shall be performed by the electrical contractor.

3.12 IDENTIFICATION AND LABELING:

A. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the successful structured cabling contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. Labeling shall follow the guidelines of ANSI/TIA/EIA-606-A.

B. All label printing will be machine generated by Panduit software (or other) using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.

3.13 TESTING AND ACCEPTANCE:

A. General
1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-B. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
2. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the Panduit Certification Program Information Manual and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

B. Copper Channel Testing
1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Horizontal cabling shall be tested using a Level III test unit for category 6 performance compliance, respectively.
2. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

3. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA/EIA-568-B.1 Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.
4. Category 6 Performance:
   a. Follow the Standards requirements established in:
      1) ANSI/TIA/EIA-568-B .1, B.2 and B.2-1
   b. A Level III test unit is required to verify category 6 performance.The basic tests required are:
      1) Wire Map
      2) Length
      3) Attenuation
      4) NEXT (Near end crosstalk)
      5) Return Loss
      6) ELFEXT Loss
      7) Propagation Delay
      8) Delay skew
      9) PSNEXT (Power sum near-end crosstalk loss)
      10) PSELFEXT (Power sum equal level far-end crosstalk loss)

C. Fiber Testing
1. All fiber testing shall be performed on all fibers in the completed end to end system. There shall be no splices unless clearly defined in an RFP. Testing shall consist of an end to end power meter test performed per EIA/TIA-455-53A. The system loss measurements shall be provided at 850 and/or 1300 nanometers for multimode fibers and 1310 and/or 1550 nanometers for single mode fibers. These tests also include continuity checking of each fiber.
2. Backbone multimode fiber cabling shall be tested at both 850 nm and 1300 nm (or 1310 and 1550 nm for singlemode) in both directions.
3. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B.
4. Where links are combined to complete a circuit between devices, the structured cabling contractor shall test each link from end to end to ensure the performance of the system. ONLY LINK TEST IS REQUIRED. The structured cabling contractor can optionally install patch cords to complete the circuit and then test the entire channel. The test method shall be the same used for the test described above. The values for calculating loss shall be those defined in the ANSI/TIA/EIA Standard.
5. Attenuation testing shall be performed with an approved hand held tester from an industry recognized test equipment manufacturer.

3.14 SYSTEM DOCUMENTATION:

A. Upon completion of the installation, the structured cabling contractor shall provide three (3) full documentation sets to the owners for approval. Documentation shall include the items detailed in the sub-sections below.

B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test result and

draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the Engineer, the structured cabling contractor shall provide copies of the original test results.

C. The Engineer may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the structured cabling contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

3.15 TEST RESULTS:

A. Test documentation shall be provided on disk within three weeks after the completion of the project. The disk shall be clearly marked on the outside front cover with the words “Project Test Documentation”, the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.

B. The field test equipment shall meet the requirements of ANSI/TIA/EIA-568-A/B including applicable TSB’s and amendments. The appropriate Level III tester shall be used to verify Category 6 cabling systems.

C. Test results generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. The structured cabling contractor must furnish this information in electronic form (CD-ROM).

D. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

3.16 AS-BUILT DRAWINGS:

A. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronic (DWG, AutoCAD rel. 2002) formats on which as-built construction information can be added. These documents will be modified accordingly by the structured cabling contractor to denote as-built information as defined above and returned to the Owner.

B. The Contractors shall annotate the base drawings and return a hard copy (same plot size as originals) and electronic (AutoCAD DWG) form.

3.17 WARRANTY:

A. The manufacturer shall provide a 25 year extended product warranty with a 25 year applications assurance warranty. Manufacturer shall provide the warranty directly to the end user.

B. An Extended Product Warranty shall be provided which warrants functionality of all components used in the system for 25 years from the date of registration. The Extended Product Warranty shall warrant the installed horizontal copper and the backbone optical fiber portions of the cabling system.

C. The Application Assurance Warranty shall cover the failure of the wiring system to support current or future applications that are designed for the link/channel specifications of ANSI/TIA/EIA–568-B.1. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, and 155 Mb/s ATM.

D. The contractor shall provide a warranty on the physical installation.

3.18 FINAL ACCEPTANCE & SYSTEM CERTIFICATION:

A. Completion of the installation, in-progress and final inspections, receipt of the test and as-built documentation, and successful performance of the cabling system for a two week period will constitute acceptance of the system. Upon successful completion of the installation and subsequent inspection, the end user shall be provided with a numbered certificate, from the manufacturer, registering the installation.

END OF SECTION 27 10 00

SECTION 27 41 00

TELEVISION DISTRIBUTION SYSTEM

PART 1 - GENERAL

A. The contractor shall provide and install a complete television distribution system as specified herein and as shown on the plans together with all accessories required to provide a complete operating system.

B. Equipment manufacturer name and model numbers specified are provided to establish quality of equipment and system operational features. Any proposed substitution of equipment from that specified must be approved by the Architect within ten (10) days prior to bid date.

C. The entire system shall be guaranteed for a period of one (1) year from the date of final acceptance of the installation and the Contractor shall repair or replace defective equipment, during this period, at no cost to the owner.

D. The system shall be designed to receive and distribute channels to all TV locations.

PART 2 - PRODUCTS

A. The line splitters shall be 2-way and 4-way as required and shall be Blonder Tongue SCVS series.

B. The directional couplers shall be Blonder Tongue SRT series as required.

C. The television distribution amplifier shall be Blonder Tongue BIDA550-50 and shall receive its input from Cable TV Company and other locations shown on the plans.

D. The receiver outlet shall consist of suitable connector mounted to wall plate. The receiver outlet shall be installed at all locations shown on the drawings.

E. All distribution cable shall be low-loss coaxial type, plenum-rated RG-6U (as manufactured by West Penn or Belden). See Specification Section 27 05 00 for additional requirements.

F. All head-end equipment shall be rack-mounted.

G. Provide filters, amplifiers, and any miscellaneous items required to rebroadcast the signal at the proper level for each channel.

H. All copper circuits routed between or outside of buildings shall be provided with a surge protection device at each end. The surge protection device shall be labeled as meeting the requirements of UL 96A (exact requirements shall be coordinated with the lightning protection system supplier, where applicable).

PART 3 - EXECUTION

A. Wiring shall be in strict accordance with the National Electrical Code and all state and local

regulations. Wiring shall be installed in accordance with manufacturer's wiring diagrams and shall test free from ground, opens and short circuits.

B. All connections shall be made under the direct supervision of a qualified technician.

C. All cables shall be terminated.

D. Wiring for the Television Distribution System is based on one manufacturer's recommendation. This contract requires that the installed wire be in accordance with the accepted manufacturer's recommendations.

E. Refer to Specification Section 27 05 00 for additional installation requirements.

F. Upon completion of job, the entire system shall be tested and a certificate shall be forwarded to the Architect be technician stating that he has personally verified the the following:
1. System is in accordance with specifications.
2. System is in correct operating condition.

END OF SECTION 27 41 00

SECTION 28 0723

SECURITY MANAGEMENT SYSTEM

PART 1 – GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. The General Conditions, Supplementary Conditions, and Division 01 P General Requirements apply.

1.2 SECTION INCLUDES

A. General description, functional requirements, operational characteristics, and criteria for the Security Management System (SMS).

1.3 RELATED SECTIONS

A. Division 26 - Electrical.

B. Division 8 - Door Hardware.

1.4 DEFINITIONS

A. API: Application Programming Interface.

B. LDAP: Lightweight Directory Access Protocol.

C. NTSC: National Television Standards Committee.

D. PAL: Phase Alternating Line. PAL is the color video standard used in Europe and many other countries.

E. SMS: Security Management System.

1.5 REFERENCE STANDARDS

A. Where more than one (1) reference standard, code, or regulation applies, the more stringent one shall govern.

B. Electronic Industries Alliance (EIA):
1. EIA RS-170 - Standard for Composite Video Signals.

C. Federal Communications Commission (FCC).
1. FCC Part 15 - Unlicensed RF Devices.
2. FCC Part 68 - Requirements for Connecting to the U.S. Phone Network.

D. Institute of Electrical and Electronics Engineers, Inc. (IEEE).

E. International Organization for Standardization (ISO).

F. International Radio Consultive Committee (CCIR).

G. Microsoft® Open Database Connectivity (ODBC) Interface.

H. National Fire Protection Association (NFPA):
1. NFPA 70 - National Electrical Code.

I. National Institute of Standards and Technology (NIST):
1. Federal Information Processing Standards Publication (FIP PUBS 197) - Specification for the Advanced Encryption Standard (AES).

J. National Television Standards Committee (NTSC):
1. Color Camera Broadcast Standard.

K. Underwriters Laboratories Inc. (UL):
1. UL 294 - Standard for Access Control System Units.
2. UL 1076 - Standard for Proprietary Burglar Alarm Units and Systems.

1.6 ACCESS CONTROL SYSTEM SHALL BE ONE OF THE FOLLOWING SYSTEMS

A. Honeywell Corporate ProWatch System vs 3.8.

B. Lenel OnGuard vs 6.4

C. Software House c Cure 9000 Enterprise

1.7 SECURITY MANAGEMENT SYSTEM (SMS) DESCRIPTION

A. The Security Management System (SMS) outlined in this section and detailed in Part 2 of this section is the key central component for managing physical security and the bridge between physical and logical security for a project. The system shall provide a variety of integral functions including: regulation of access and egress; provision of identification credentials; monitor, track and interface alarms.

B. The SMS shall utilize a single seamlessly integrated relational database for all functions utilizing a fully multi-tasking multi-threading Microsoft Windows 7 or 2008 or Vista or XP or 2003 Operating System. The SMS shall be written so that all system modules (access control, alarm monitoring, ID or credential management, visitor management, asset management and digital video management) are developed and built from a unified single 32-bit source code set. Separate source code bases for individual modules of the SMS are not acceptable.

C. Upgrades or expansion of the SMS to a larger size system in scale shall not require installation of a different and/or new SMS application or require the administrator or operator to learn a different and or new interface from the previous version.

D. The SMS shall be written using Unicode format. Unicode enables a single software product to be targeted across multiple platforms and languages without re-engineering and allows for data to be transported through different systems without corruption. Language Accessory Add-ons shall require a special language-specific license bit in order for the Language Pack to be used. E. The SMS software developer shall be a Microsoft Gold Certified Partner.

F. The SMS shall be Microsoft Windows XP Certified.

G. The SMS shall be compatible with Microsoft Windows 7, and shall have passed Microsoft-designed tests for compatibility and reliability on Windows 7.

H. The SMS shall be UL 1076 Listed (pending).

I. The SMS shall have FIPS 140-2 certification (pending).

J. The SMS shall only require a single license key to be present on the database server for the SMS to operate. The license key shall either be a physical device or a software license key. The SMS shall allow the SMS USER the ability to activate, return, or repair the software license key. The software license shall only be used on a physical computer or in a VMware virtual environment. License keys shall not be required at the client workstations. The license key on the database server shall determine the number of client workstations that shall be able to connect to the SMS as well as all SMS functionality. An alarm shall be generated in the SMS's Alarm Monitoring application as the license expiration date approaches.

K. The License Administration login and password shall be encrypted when they are passed to the License Server. The hash shall not be the same data even with the same logon credentials on different systems. This is a requirement for U.S. government DIACAP certification.

L. The SMS shall support concurrent licensing with respect to client licenses. CUSTOMER shall purchase a fixed number of client workstation licenses (or connections) that shall be programmed into the database server license file. The SMS shall be installed on any number of client workstations in the CUSTOMER facility. Then, any of the client workstations that have the SMS software installed shall have the ability to connect to the database server as long as the maximum number of concurrent connections purchased has not been reached. Connections shall be licensed on a per module basis. This shall provide CUSTOMER with great flexibility in system design and layout.

M. The SMS shall provide support for single sign-on capability. Single sign-on shall allow System Administrators/System Operators to authenticate into SMS applications using their Windows domain account.

N. Single sign-on shall support the following scenarios:

1. Allow System Administrators/System Operators to interactively run SMS applications without having to enter a username or password. This shall make administration of the SMS easier since maintenance of separate SMS usernames and passwords is not required.

2. Allow SMS API scripts to authenticate. These scripts shall be run using a Windows account allowing a seamless and secure way to authenticate the account and restricting the script to those actions that the user is permitted to perform.

O. The SMS shall be able to seamlessly interface with and monitor intelligent system controllers, reader interface modules, I/O panels, alarm panels, alarm panel receivers, biometric devices, personal protection devices, intercom systems, fire alarm panels (secondary monitoring only), building management systems and digital video recorders approved for use by the SMS manufacturer.

P. The SMS shall be able to communicate with intelligent system controllers via RS-485, RS-232, TCP/IP or Ethernet, and dialup via modem.

Q. Tasks shall be accessible from any compatible client workstation on the network utilizing one (1) or all of the following:

1. Traditional client-server architecture.
2. N-tier architecture where the SMS supports the expansion of the system architecture and allows for user deployment based upon their system architectural needs. The SMS shall allow for, but not require, the separation of the database, application server, Web server, and client interface. The system shall require that all connections to the database be performed through a trusted link from the client or internet browser interface.
3. Centralized distribution (publishing) of applications using Windows Terminal Server and Citrix® on Windows, UNIX, Linux or Apple Macintosh based systems through any compatible internet browser application and/or by means of a mobile computing platform using a wearable computer, Tablet PC, or PDA device.

R. Utilize an open architecture where all data must reside on a single database and must be accessible in real time to SMS workstation or Web-based client connected to the network. The system shall be configurable to support all of the following databases: Microsoft SQL Server 2008, Microsoft SQL Server 2005, Oracle Server 11g, and Oracle Server 10g. Oracle data may reside on Windows or UNIX platforms.

S. The system architecture shall support Microsoft Windows Clustering, Hot Standby, Fault Tolerant Servers and Fault Tolerant Hot Standby Servers.

T. The SMS shall be able to connect to and interface bi-directionally with external data sources utilizing all of the following methods:

1. ASCII with support for XML formatted text exchange of data activated both manually and automatically.
2. ASCII with support for XML formatted text exchange of data using a direct table interface activated both manually and automatically.
3. Real-time exchange of data via Active Directory or LDAP utilizing an API (Application Programming Interface) written by the SMS manufacturer. The live exchange of data shall expose SMS events and transactions to other data sources in real-time and allow for receipt of data into the SMS where this data may be acted upon and trigger linked events in the SMS in real-time.

U. All exterior cameras will be grouped in such a manner as to allow access by owner and Elmore County Sheriff's Department. All interior cameras will be grouped in such a manner as to allow access by owner only.

1.8 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Reference each product to a location on Drawings.

1. Manufacturer's technical data for all material and equipment at the system and sub system level to be provided as part of the SMS.

2. A system description including analysis and calculations used in sizing equipment required by the SMS. The description shall show how the equipment will operate as a system to meet the performance requirements of the SMS. The following information shall be supplied as a minimum:

a. Server(s) processor(s), disk space and memory size.
b. Description of site equipment and its configuration.
c. Network bandwidth, latency and reliability requirements.
d. Backup or archive system size and configuration.
e. Start up operations.
f. System expansion capability and method of implementation.
g. System power requirements and UPS sizing.
h. Device or component environmental requirements (cooling and or heating parameters).
i. A description of the operating system and application software.

B. Shop Drawings: Submit plans, elevations, sections, details, and attachments to other work.
1. Indicate all system device locations on architectural floor plans. No other system(s) shall be Included on these plans.
2. Include full schematic wiring information on these drawings for all devices. Wiring Information shall include cable type, conductor routings, quantities, and connection details at device.
3. Include a complete SMS one-line, block diagram.
4. Include a statement of the system sequence of operation.

C. Operation and Maintenance Data: For electronic security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23, include the following:
1. Provide Six (6) sets electronic format manuals including operating instructions, maintenance recommendations and parts list including wiring and connection diagrams modified to reflect as-built conditions.
2. Manuals: Deliver final copies of the manuals within thirty (30) days after completing the installation test. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the Contractor responsible for the installation and maintenance of the system and the factory representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation test shall include all modifications made during installation, checkout, and acceptance testing. The manuals shall consist of the following:

a. Functional Design Manual: Identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. Include a description of hardware and software functions, interfaces, and requirements.
b. Hardware Manual: Describe equipment furnished including:
    1) General description and specifications.
    2) Installation and check out procedures.
    3) Equipment layout and electrical schematics to the component level.
    4) System layout drawings and schematics.

5) Alignment and calibration procedures.
6) Manufacturer's repair parts list indicating sources of supply.

c. Software Manuals: Describe the functions of software and include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
1) Definition of terms and functions.
2) System use and application software.
3) Initialization, startup, and exit.
4) Reports generation.
5) Details on forms customization and field parameters.

3. As-Built Drawings: During system installation, the Contractor shall maintain a separate hard copy set of drawings, elementary diagrams, and wiring diagrams of the SMS to be used for record drawings. This set shall be accurately kept up to date by the Contractor with all changes and additions to the SMS. Copies of the final as-built drawings shall be provided to the end user in DXF format.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. SMS manufacturer shall be an established organization with referenced and documented experience delivering and maintaining SMS of equal or higher sophistication and complexity as compared to the system detailed in this specification.
2. SMS manufacturer shall employ at a minimum the following methods for quality assurance of component and assembly devices.
a. Perform visual inspection of devices to verify assembly according to defined procedures. Perform end of line operational tests to ensure product functionality has been correctly configured.
3. Perform individual functionality and system level regression testing to ensure compliance with product specifications. Perform single and multiple unit system tests to mimic end-user installation configurations. Utilize automated hardware and software testing to evaluate system performance under published operational loads and compare to published system capabilities.

B. Bidder Qualifications:

1. At the time of the bid, the bidder shall have satisfactorily completed projects of a similar size, scope and complexity as the system detailed in this specification. The bidder shall furnish written proof of experience from three (3) references and proof of current accreditation or certification by the manufacturer for required training for sales or installation or service of the SMS and associated devices.
2. Bidder shall be a Microsoft Certified Partner
3. The bidder shall also be a factory authorized local service organization that shall carry a complete stock of parts and provide maintenance for the SMS and related systems under this contract. Local shall be defined as an area in a 75 mile radius of installed location.

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging.

B. Store components and equipment in temperature and humidity controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 degrees Fahrenheit (10 and 29.4 degrees Celsius), and not more than 80 percent relative humidity, non-condensing.

C. Open each package; verify contents against packing list; and file copy of packing list, complete package identification, for inclusion in operation and maintenance data.

D. Mark packing list with the same designations assigned to materials, components, and equipment for recording in the system labeling schedules that are generated by software.

E. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.11 PROJECT CONDITIONS

A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
   1. Equipment and Components: Rated for continuous operation in ambient conditions of 60 to 85 degrees Fahrenheit (15.5 and 29.4 degrees Celsius) and a relative humidity of 20 to 80 percent, non-condensing.
   2. Indoor, Controlled Environment: NEMA 250, Type 1 enclosure. System components, except the central-station control unit, installed in [air-conditioned] [temperature- controlled] indoor environments shall be rated for continuous operation in ambient conditions dry bulb and 20 to 90 percent relative humidity, non-condensing.
   3. Indoor, Uncontrolled Environment: NEMA 250, [Type 3R] [Type 4] [Type 12] [Type 12K] enclosures. System components installed in [non-air-conditioned] [non-temperature-controlled] indoor environments shall be rated for continuous operation in ambient conditions dry bulb and 20 to 90 percent relative humidity, non-condensing.

1.12 WARRANTY

A. Guarantee equipment and labor and provide maintenance and services as follows: WARRANTY REQUIREMENTS FOR ALL SYSTEM COMPONENTS (LABOR and MATERIAL): 5 year (60 month) warranty on parts and labor for the access control system shall be included with bid.

B. This 60-month warranty shall include the following elements:

   1. 8-5, M-F Service, Service Provider must be same as bidder.
   2. Web Portal for creating service tickets and tracking service requests.
   3. Priority queue for service requests.

4. Electrical Surge Protection coverage.
5. Guaranteed Emergency Response - four (4) hours.
6. Guaranteed Non-Emergency Response - six (6) business hours.
7. Remote System Help Desk Support for Technical Support - 1 time per quarter.
8. Software License Technical support agreements and Installation of annual software updates 1 per year for 5 years.
9. On-Site System Review and Audit of System Functionality - 1 time per year.
10. Component Integrity Inspections - 2 times per year.
11. Replacement of Disposable Parts as needed (batteries, bulbs, connectors, etc.).
12. Training for office personnel on system functionality - 2 times per year.

1.13 SMS STARTUP AND COMMISSIONING

A. Entire security management system shall be commissioned by the manufacturer or manufacturer's representative.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: The security management system is based on products of Lenel Systems International, Inc., 1212 Pittsford-Victor Road, Pittsford, NY 14534; telephone: 585-248-9720, fax: 585-248-9185; Web site: www.lenel.com.

B. Honeywell Integrated Security, 135 West Forest Hill Avenue, Oak Creek, WI 53154; Phone: 414-766-1700, Fax: 414-766-1798; Web site: www.HoneywellIntegrated.com.

C. Software House, 6600 Congress Avenue, Boca Raton, FL 33487; Phone: 800 507 6268; Web site: www.swhouse.com.

2.2 ACCESS CONTROL CREDENTIAL READERS

A. Proximity Card Readers P Single-Gang Box Mounting (Thinline II)

1. Provide surface mounting style 125 KHz proximity card readers suitable for wall or US 2-S single-gang box mounting, and for mounting configurations as shown on the project plans.
2. The reader shall be capable of reading access control data in standard Wiegand formats up to 84 bits in length from any HID Proximity card or equivalent, outputting the data in one of the following configurations:
   a. The card reader shall output credential data in compliance with the SIA AC-01 Wiegand standard, compatible with all standard access control systems.
   b. The card reader shall output credential data using a Clock and Data interface, and be compatible with systems requiring a magnetic stripe reader.
3. The reader shall be capable of outputting a periodic reader supervision message at a configurable time interval, enabling the host system to signal an alarm condition based on the absence of this message.
4. The Proximity card reader shall provide the ability to change operational features in the field through the use of a factory-programmed command card. Command card operational programming options shall include:
   a. Reader beeps and flashes green on a card read, LED normally red, single line control of LED.

b. Reader flashes green on a card read, LED normally red, single line control of LED.
c. Reader beeps on a card read, LED normally red, single line control of LED.
d. Beeper and LED are controlled by host only, LED normally red, single line control of LED.
e. Reader beeps and flashes green on a card read, LED normally off, red and green LED's controlled individually.
f. Reader flashes green on a card read, LED normally off, red and green LED's controlled individually.
g. Reader beeps on a card read, LED normally off, red and green LED's controlled individually.
h. Beeper and LED are controlled by host only, LED normally off, red and green LED controlled individually
i. Change from Wiegand to Mag Stripe output format
j. Change from Mag Stripe to Wiegand output format
k. Reset to Factory Defaults

5. Proximity card readers shall provide the following programmable audio/visual indication:
a. A piezoelectric sounder shall provide an audible tone upon successful power up/self test, good card read, or whenever the beeper control line is asserted by the host.
b. A bi-color, red/green LED shall light upon successful power up/self test, good card read, or whenever the LED control line(s) are asserted by the host.
c. The reader shall have individual control lines for the sounder, and for red and green LED indication. When the LED control lines are asserted simultaneously, an amber LED indication will occur.
6. The reader shall have a configurable hold input, which when asserted shall either buffer a single card read or disable the reader, until the line is released. This input may be used for special applications or with loop detectors.
8. The reader shall require that a card, once read, must be removed from the RF field for one second before it will be read again, to prevent multiple reads from a single card presentation and anti-passback errors.
9. Typical proximity card read range shall be:
a. 5.5” (14cm) using HID Proxcard II card.
b. 2” (5.1 cm) using HID ProxKey II key fob
c. 3” (7.6 cm) using HID Microprox Tag
d. 1.5” (3.8 cm) using HID Prox/Wiegand Card
10. Proximity card readers shall meet the following physical specifications:
a. Dimensions: 4.70 x 3.0 x 0.68” (11.9 x 7.6 x 1.7 cm)
b. Weight: 3.3.oz (94 g)
c. Material: UL94 Polycarbonate
d. Two-part design with separate reader body and cover.
e. Color: Black, Gray, White or Beige as approved by the project architect.
11. Proximity card readers shall meet the following electrical specifications:
a. Operating voltage: 5P 16 VDC, reverse voltage protected. Linear power supply recommended.
b. Current requirements: (average/peak) 20/115mA @ 12 VDC 13. Proximity card readers shall meet the following certifications:

a. UL 294
b. Canada/UL 294
c. FCC Certification

14. Proximity card readers shall meet the following environmental specifications:
a. Operating temperature: -22 to 150 degrees F (-30 to 65 degrees C)
b. Operating humidity: 0% to 95% relative humidity non-condensing
c. Weatherized design suitable to withstand harsh environments The reader shall be of potted, polycarbonate material, sealed to a NEMA rating of 4X (IP55).

15. Warranty of Proximity card readers shall be lifetime against defects in materials and workmanship.

2.3 PROXIMITY CARDS

A. Furnish 150 proximity cards for owner's use.

2.4 PANIC BUTTONS

A. Panic buttons at clerical stations shall be United Security Products HUB-ES emergency switch mounted to casework.

B. Wall mounted panic buttons shall be a mushroom style push-button located at 48" AFF with plexiglass cover.

2.5 DOOR CONTACT SWITCHES

A. Door contact switches shall be GE Security 1072 recess mounted magnetic contacts. Coordinate exact location with door hardware supplier.

2.6 SERVER AND WORKSTATION REQUIREMENTS

A. Contractor shall furnish Cisco switches (exact model to be approved by DHR) for all Security Management System needs.

B. Database Servers
1. Servers for Windows 2008 or 2003 Access Control and Alarm Monitoring Systems
a. Dell PowerEdge R710
b. Intel® Xeon® E5520, 2.26Ghz, 8M Cache, Turbo, HT, 1066MHz
c. 4GB Memory (2x2GB), 1066MHz Dual Ranked UDIMMs for 1 Processor, Adv ECC
d. 24X IDE CD-RW/DVD ROM Drive
e. 160GB 7.2K RPM SATA 2.5" Hot Plug Hard Drive for Operating System
f. 160GB 7.2K RPM SATA 2.5" Hot Plug Hard Drive for Database
g. RD1000 Backup, Internal SATA Drive Bay for 2.5" Chassis
h. RD1000 Internal Removable Hard Disk for RD1000, 160GB Native / 320GB Comp
i. Four 10/100/1000 Ethernet Network Ports
j. 17 in. Flat LCD Monitor
k. Onboard VGA
l. 1 serial port
m. 6 USB 2.0 ports
n. Speakers

o. USB Keyboard
p. USB Optical Mouse
q. Surge Suppression Strip
r. Microsoft Windows Server 2008 or 2003 Operating System
s. Microsoft SQL Server 2008 or 2005 Relational Database Management System
t. SMS Server Software for Windows 2008 or 2003

2. Servers for Windows 2008 or 2003 PRO Access Control and Alarm Monitoring Systems
a. Dell PowerEdge R710
b. Intel® Xeon® E5520, 2.26Ghz, 8M Cache, Turbo, HT, 1066MHz Max Mem
c. 4GB Memory (2x2GB), 1066MHz Dual Ranked UDIMMs for 1 Processor, Adv ECC
d. 24X IDE CD-RW/DVD ROM Drive
e. 160GB 7.2K RPM SATA 2.5" Hot Plug Hard Drive for Operating System
f. 160GB 7.2K RPM SATA 2.5" Hot Plug Hard Drive for Database
g. RD1000 Backup, Internal SATA Drive Bay for 2.5" Chassis
h. RD1000 Internal Removable Hard Disk for RD1000, 160GB Native/320GB Comp
i. Four 10/100/1000 Ethernet Network Ports
j. Onboard VGA
k. 17 in. Flat LCD Monitor
l. 1 serial port
m. 6 USB 2.0 ports
n. Speakers
o. USB Keyboard
p. USB Optical Mouse
q. Surge Suppression Strip
r. Microsoft Windows Server 2008 or 2003

s. Microsoft SQL Server 2008 or 2005 Relational Database Management System
t. SMS Server Software for Windows 2008 or 2003

3. Servers for Windows 2008 or 2003 Credential Management Systems
a. Dell PowerEdge R710
b. Intel® Xeon® E5520, 2.26Ghz, 8M Cache, Turbo, HT, 1066MHz Max Mem
c. 4GB Memory (2x2GB), 1066MHz Dual Ranked UDIMMs for 1 Processor, Adv ECC
d. 24X IDE CD-RW/DVD ROM Drive
e. 160GB 7.2K RPM SATA 2.5" Hot Plug Hard Drive for Operating System
f. 160GB 7.2K RPM SATA 2.5" Hot Plug Hard Drive for Database
g. RD1000 Backup, Internal SATA Drive Bay for 2.5" Chassis
h. RD1000 Internal Removable Hard Disk for RD1000, 160GB Native/320GB Comp
i. Four 10/100/1000 Ethernet Network Ports
j. Onboard VGA
k. 17 in. Flat LCD Monitor
l. 1 serial port
m. 6 USB 2.0 ports
n. Speakers
o. USB Keyboard

p. USB Optical Mouse
q. Surge Suppression Strip
r. Microsoft Windows Server 2008 or 2003 Operating System
s. Microsoft SQL Server 2008 or 2005 Relational Database Management System
t. SMS Server Software for Windows 2008 or 2003 4. Servers for Windows 2008 or 2003 Integrated Systems
a. Dell PowerEdge R710
b. Intel® Xeon® E5520, 2.26Ghz, 8M Cache, Turbo, HT, 1066MHz Max Mem
c. 4GB Memory (2x2GB), 1066MHz Dual Ranked UDIMMs for 1 Processor, Adv ECC
d. 24X IDE CD-RW/DVD ROM Drive
e. 160GB 7.2K RPM SATA 2.5" Hot Plug Hard Drive for Operating System
f. 160GB 7.2K RPM SATA 2.5" Hot Plug Hard Drive for Database
g. RD1000 Backup, Internal SATA Drive Bay for 2.5" Chassis
h. RD1000 Internal Removable Hard Disk for RD1000, 160GB Native/320GB Comp
i. Four 10/100/1000 Ethernet Network Ports
j. Onboard VGA
k. 17 in. Flat LCD Monitor
l. 1 serial port
m. 6 USB 2.0 ports
n. Speakers
o. USB Keyboard
p. USB Optical Mouse
q. Surge Suppression Strip
r. Microsoft Windows Server 2008 or 2003 Operating System
s. Microsoft SQL Server 2008 or 2005 Relational Database Management System
t. SMS Server Software for Windows 2008 or 2003

B. Client Workstations PC Specifications

1. Client Workstations for Windows 2008 or 2003 SYSTEMS

a. Intel Pentium 4 Dual Core E2180, 2.0GHz, 1M L2 Cache, 800FSB
b. 1GB non-ECC, 667MHz DDR2 1x1GB (1DIMM)
c. 24X CD-RW/DVD Combo Drive
d. 80GB SATA II 3.0Gb/s, 8MB Cache, 7200 RPM hard drive
e. 10/100/1000 Ethernet Network Port
f. 1 serial port
g. 1 parallel port
h. 8 USB 2.0 ports
i. 17 in. Flat LCD Monitor
j. 64 MB Video Card
k. Speakers
l. USB Keyboard
m. USB Optical Mouse
n. Surge Suppression Strip
o. Microsoft Windows XP or Vista
p. Microsoft SQL Server 2008 or 2005 Client License

q. SMS Client Software for Windows XP or Vista
2. System Administration only
a. Dell OptiPlex 780 Small Form Factor
b. Intel® Pentium® Dual Core E5300 with VT (2.60GHz, 2M, 800MHz FSB)
c. 4GB DDR3 Non-ECC SDRAM, 1066MHz, (4 DIMM)
d. 8X Slimline DVD+/-RW
e. 160GB 7,200 RPM 3.5" SATA, 3.0Gb/s Hard Drive with NCQ and 8MB Cache
f. 10/100/1000 Ethernet Network Port
g. 1 serial port
h. 1 parallel port
i. 8 USB 2.0 ports
j. 19 in. Flat LCD Monitor
k. Integrated Video, Intel® GMA 4500
l. Internal Chassis Speakers
m. USB Keyboard
n. USB Optical Mouse
o. Surge Suppression Strip
p. Microsoft Windows 7
q. Microsoft SQL Server 2008 Client License
r. SMS Client Software for Windows 7
3. High Performance Video Viewing
a. Dell T3500 Precision Workstation
b. Intel® Quad Core Xeon® W3520 2.66GHz, 8M L3, 4.8GT/s, Turbo
c. 4GB, 1066MHz, DDR3 SDRAM, NECC (4 DIMMS)
d. 16X DVD+/-RW
e. 250GB SATA 3.0Gb/s with NCQ and 8MB DataBurst Cache
f. 10/100/1000 Ethernet Network Port
g. 1 serial port
h. 8 USB 2.0 ports
i. 19 in. Flat LCD Monitor
j. Dual 256MB NVIDIA® Quadro® NVS 295, 4MON, 4DP w/ 4DP to DVI Adapt k. Internal Chassis Speakers
l. USB Keyboard
m. USB Optical Mouse
n. Surge Suppression Strip
o. Microsoft Windows 7
p. Microsoft SQL Server 2008 Client License
q. SMS Client Software for Windows 7

2.7 COMPONENTS

A. SMS Software Capabilities: Support an unlimited number of card readers, input points, video cameras, intrusion detection points, and relay outputs. The SMS database server shall support an unlimited number of cardholders, visitors, and assets limited only by the available memory on the ISC. The database server shall also support an unlimited number of system events and

System Operator transactions in the history file limited only by available hard disk space. Client Workstations shall be limited only by the limitations of the operating system server software. The SMS functions are catergorizedinto nineteen primary “system modules” which shall include:

1. Access Control
    a. One of the SMS's primary purposes shall be to provide access control. The SMS shall be able to make access granted or denied decisions, define access levels, and set timezones and holidays. An input or output linkage feature shall allow linking of monitor zone points to output control points within Intelligent System Controllers (ISCs). The SMS shall support features such as area control (two man control, hard, soft, and timed anti-passback), database segmentation, and timezone or holiday overrides.
2. Alarm Monitoring
    a. The main Alarm Monitoring window shall provide information about the time and location of the alarm, along with its priority. The main Alarm Monitoring window must be able to sort pending and/or insert new alarms based on any of the following attributes: priority, date or time, alarm description, Intelligent System Controller, Card Reader, Input Control Module, asset name, or cardholder. Date or time sorts must be System Operator selectable to be either ascending or descending and must have the option of displaying the seconds of the minute in which the alarm arrived into the SMS. All columns of information in the main Alarm Monitoring window shall be able to be arranged in any order by the System Operator.
    b. The SMS must allow unique emergency instructions to be specified for each type of alarm. It shall also allow for the automatic sending of alphanumeric pages or e-mail messages upon alarm arrival. A real-time graphical system status tree on the screen shall indicate if card readers, alarm panels, digital video recorders, video cameras, intrusion detection panels, or Intelligent System Controllers are secured, unsecured, in alarm, or offline. Output control operations must be available to lock, unlock or pulse control points as a standard feature. An automatic cardholder call-up feature shall allow the quick search and display of images in the database. A System Operator journal shall be available to log important daily events. A trace function shall be available for System Operators to locate and track activity on specific cardholders, assets, video cameras, or card readers. An image comparison feature must be provided for use in conjunction with a CCTV interface. All alarms and hardware icons MUST have the ability to control the associated hardware via right-mouse clicks.

    c. The SMS must provide the option to be used as a UL 1981 Classified Central Station Automation System. This option must be classified by Underwriters Laboratories for use as a Commercial Burg Central Station Automation System, to allow the monitoring station where it is used to be made compliant with the UL 1981 standard and listed by UL. This classification shall apply to alarm panels monitored through a connected, UL approved Central Station Alarm Receiver.
3. Credential Management

a. The SMS shall include a seamlessly integrated credential management module. The credential management functionality must allow the enrollment of cardholders into the database, capturing of images, biometric data, and signatures, as well as the import or export of employee data. This functionality shall also allow the System Operator to assign and/or modify the access rights of a cardholder.
b. The SMS shall include a seamlessly integrated state-of-the-art, 32-bit, credential creation and production system. This shall allow for the creation of different badge types based on a database field, the linking of that field to a badge type to automate the process of credential production, and the use of security colors, chromakey, and ghosting, to allow officers to quickly identify personnel access authority.
c. The SMS shall have capabilities for biometric verification. Through the enrollment and comparison of hand geometry (the size of an individual's hand and fingers), or fingerprints, the identity of an individual shall be verified.
d. The SMS shall have the ability to crop and rotate an image automatically based on the orientation of the eyes found in the image. This shall include photographs captured from digital cameras, live cameras, scanned images and imported images.

4. Visitor Management
   a. The SMS shall include a visitor management module. The visitor management module shall be an application utilizing technology that allows a CUSTOMER to enroll and track visitors of the organization.
   b. The visitor management module shall allow a CUSTOMER to enroll visitors, sign them in or out, capture a photo, and capture a driver's license or passport. The visitor management module shall allow System Operators to enter and preschedule visits. The visitor management module shall allow System Operators to print visitor badges.
5. Remote Access Level Management
   a. The SMS shall include a seamlessly integrated remote access level management module.The remote access level module shall be a desktop-based application technology that allows CUSTOMER managers to assign and remove access levels to and from cardholders in the existing SMS database. All transactions relating to the adding and/or removal of access levels shall be recorded complete with a time and date stamp and the System Operator who made the change.
6. System Administration
   a. System Administrative tasks such as defining client workstation and System Operator permissions set-up, access groups, timezones, reports, maps, etc. shall be provided from any client workstation on the network. Initial setup of the cardholder screen layout shall occur on the database server. The SMS shall support the use of strong passwords.
7. Badge Layout Creation
   a. The SMS shall provide a Badge Layout Creation and Editing Module to allow for the creation of custom badge designs to be created by the CUSTOMER. The SMS shall support credit card, government, and custom credential sizes in

either a landscape or portrait format and shall support double sided and edge-toedge printing.

8. Screen or Forms Creation
    a. The SMS shall provide a Forms Designing and Editing Module that gives System Administrators the ability to modify any standard field to customize any or all of the cardholder, asset, or visitor forms. The SMS shall also allow System Administrators to add custom fields in addition to any standard fields on a minimum of 32 pages each of information for cardholder, visitor, and visit related data. User-defined fields absolutely shall not be pre-defined, meaning only the labels can change while the properties cannot. System Administrators shall have a minimum of 96 pages of which to design their cardholder, visitor, and visit screens with standard and custom fields.
9. Graphical Map Creation
    a. The SMS shall provide Graphical Map Creation and Editing Software that must allow System Administrators to import customized map backgrounds of their facility and to attach custom icons to those maps.
10. Application Programming Interfaces
    a. The SMS shall provide a set of standard Application Programming Interfaces (API's) and supporting documentation that allows hardware manufacturers and software application developers to integrate their products into the SMS. The Application Programming Interfaces shall allow requests from CUSTOMER to integrate a third- party hardware or software solution based on SMS open architecture and SMS device independence.
11. Data Import
    a. The SMS shall support an import utility that will allow the CUSTOMER or VAR to import cardholder information into the SMS database. This shall allow the CUSTOMER or VAR to pre-populate the SMS database with existing cardholder data and/or add new records to the existing SMS database.
12. Bi-Directional Data Exchange
    a. The SMS shall support a real time, bi-directional data interface to external databases such as Human Resources, Time and Attendance, Food Service Systems. The interface shall allow data to be imported into or exported out of the SMS in real-time or in a batch mode basis. Data used for import shall be retrieved directly from an external database or through an import file. Data provided for export shall be applied directly to an external database or through an export file. Any data shall be imported or exported including image data. The file used for import or created by export shall have the ability to be structured in a wide variety of ways, but shall always be in ASCII text format.
    b. The SMS shall also support a one step download and distribution process of cardholder and security information from the external database to the SMS database, all the way down to the Intelligent System Controller (ISC) database. This shall be a guaranteed process, even if the communication path between the SMS database server and the ISC is broken. If the communication path is broken, the data shall be stored in a temporary queue and shall be automatically downloaded once the communication path is restored.
13. API Development Toolkit

a. The SMS shall allow, through API toolkits, System Administrators to expose specific SMS data and events that are relevant to IT information or other thirdparty systems. Conversely, the SMS shall allow, through these same API toolkits, System Administrators to accept and process information exposed from the IT information or other third-party systems. This shall permit System Administrators to develop scripts and applications that allow events in either the IT domain to cause appropriate actions in the Security domain, and vice versa.

14. Server Redundancy
    a. The SMS shall support a fault tolerant server and redundant database architecture. The SMS shall also allow for a server clustering architecture. The SMS shall allow for normal operations to occur in the event that the Database Server fails. In the event of a server failure, the switch over to a backup server from a primary server shall be automatic and not impede the operation of the SMS.

B. SMS Software Functionality:
1. Timezones:
    a. The SMS shall be capable of creating and storing up to 255 timezones. Each timezone shall have a minimum of six (6) intervals. Each interval shall be assignable to any day of the week.
    b. Each timezone shall be assignable to an alphanumeric name of up to 64 characters. Timezones shall be applied to access levels, card reader modes, alarm inputs, alarm outputs, and alarm masking and logging functions. Timezones shall be allowed to belong to any or all access levels so that the timezone only has to be defined once.
2. Access Levels:
    a. Capable of defining a minimum of 32,000 access levels with a minimum of 128 access levels per cardholder per database segment. Access levels shall consist of a combination of card readers and timezones.
    b. Each access level shall be assignable to an alphanumeric name using up to 64 characters.
    c. Card readers shall have the ability to be assigned to any or all access levels defined in the SMS. Individual card readers shall be capable of having a distinct timezone assigned to it.
    d. Allow an ‘Allow User Commands’ option to be assigned on a per access level basis where keypad readers are in use.
    e. Allow a ‘First Card Unlock’ option to be assigned on a per access level basis.
3. Temporary Access Levels:
    a. Capable of assigning Temporary Access Levels inclusive of the 32,000 assignable Access Levels.
    b. Each Temporary Access Level shall be assignable to an alphanumeric name using up to 64 characters.
    c. Each Temporary Access Level shall be definable with a start and end date.

   d. Temporary Access Levels shall be stored in the ISC and functionality shall be maintained in the event of disconnection with the ISC.
4. Access Groups:
   a. The SMS shall be capable of assigning Access Groups with a maximum of 32 Access Levels per Access Group.
   b. Each Access Group shall be assignable to an alphanumeric name using up to 64 characters.
5. Precision Access Levels:
   a. The SMS shall be capable of assigning Precision Access Levels in addition to the 32,000 Access Levels with the ability to assign unlimited card reader and timezone combinations.
   b. Each Precision Access Level shall be assignable to an alphanumeric name using up to 64 characters.
6. Holidays:
   a. The SMS shall provide a minimum of 255 Holiday assignments using an embedded calendar. Holidays shall be assigned an alphanumeric name using up to 64 characters and shall be grouped into eight (8) types of holidays, and shall be assignable to individual timezones. Access rights, card reader modes, and alarm masking schedules must be able to be altered when the current date is designated a Holiday.
   b. Dates for Daylight Saving Time changes shall be definable and shall take effect automatically.
   c. The SMS shall support Holiday Ranges that allow a single holiday to span across multiple calendar days.
7. First Card Unlock: Feature that when configured retards a pre-determined timezone activated unlock command until a valid credential has been presented and granted access to the portal.
8. Database Segmentation: Support data segmentation whereby each segment shall have its own set of cardholders, field hardware and system parameters (timezones, access levels etc.). This segmentation shall expand the limitations of the SMS parameters (that is, access levels and timezones) to the maximum capacity of each parameter multiplied by the number of segments.
9. Field Hardware Communications:
   a. The SMS shall communicate with the ISCs by the following protocols: 1) RS-232
      2) RS-485
      3) TCP/IP
      4) Dialup via Modem
   b. Communication baud rate shall be system selectable with a range between 1,200 to 115,200 bits per second.
   c. Download communication between the SMS and the ISC shall be fully multi-tasking and shall not interfere with operational functions.
   d. Upon loss of communications between the SMS Server and the ISC an alarm shall be created with a time stamp. Upon re-established communication the SMS and the ISC shall automatically re-synchronize from the point of communication loss without operator intervention.
10. Multi-Drop Panel Support:

a. Support a multi-drop Intelligent System Controller architecture whereby up to eight (8) ISCs shall be multi-dropped on a single RS-485 communications line and whereby all eight panels communicate back to a single serial communications port.
b. The multi-drop panel support shall be used in conjunction with other ISC wiring support such as the star wiring configuration, home-run wire architecture, and advanced distributed network architecture.

11. Intelligent System Controller Remote Dialup Support:
    a. Support Remote Dialup operations to and from the Intelligent System Controller (ISC). The dialup connection shall be either a constant connection or a scheduled connection. If the connection is constant, then every panel shall have its own modem at the host. If the connection is scheduled, then all panels using remote dialup shall have the ability to share the same host modem(s).
    b. The LNL-2220 and LNL-3300 shall have native 10/100 Ethernet.
    c. System Administrators shall have the ability to define the modems available in the pool. For each modem, System Administrators shall be able to define the modem type and the client workstation that it is installed to.
    d. Dialup sessions shall occur under any of the user-defined scenarios:
        1) On Demand Connection: A System Operator shall have the ability to automatically initiate a dial in session to an ISC via the Alarm Monitoring application. 2) Scheduled Connection: System Administrators shall have the ability to configure the SMS so that the ISC dials into the SMS at a pre-determined times through use of timezones.
        3) Critical Alarm Activated: System Administrators shall have the ability to configure the SMS so that the ISC initiates a dialup session with the SMS when a critical alarm is activated in the field.
        4) Buffer Threshold: System Administrators shall have the ability to configure the SMS so that the ISC initiates a dialup session with the SMS when a pre-determined number of events are stored in the ISC memory buffer.
12. SMS to Intelligent System Controller Encryption
    a. Data security for encrypted connections between SMS and Intelligent System Controllers shall be provided by the full implementation of the Federal Information Processing Standard, FIPS-197, utilizing the 128-bit Advanced Encryption Standard (AES), also known as Rijandael, a symmetric encryption algorithm. The 128-bit AES encryption MUST be certified by the National Institute of Standards and Technology (NIST). FIPS-197 supersedes the aging Data Encryption Standard (DES) defined in FIPS-46-3. Implementation of FIPS-197 shall solve the data security requirements for open network connections by providing a means to secure the data over the non-secure network by encryption.
    b. The Intelligent System Controllers shall also support a 32-bit issue code. This shall only be used when implementing a Physical Access Control Systems (PACS) low and medium security profile enhancement.
13. Intelligent System Controller to Reader Interface and I/O Module Encryption
    a. Data security for encrypted connections between Intelligent System Controller and downstream modules (Reader interface and I/O Modules) shall be provided by utilizing the 128-bit Advanced Encryption Standard (AES), also known as Rijandael, a symmetric encryption algorithm.

b. The encryption between the ISC and downstream modules must support use of a diversified session key derived from a shared secret master key algorithm. The shared secret master key must be settable to insure uniqueness, and to authenticate connected modules prior to activating them for the session.

14. Area Control: Provide eight (8) area control features: Global Hard Anti-passback, Global Soft Anti-passback, Timed Anti-passback, Two Person Control, Designated One Person Control, Designated Two Person Control, Tail Gate Control, and Occupancy Limit. Area control shall be a security method of preventing a person from passing their badge to another person for dual entry into a single location utilizing one (1) card.
    a. The following summary criteria shall apply under Global Hard or Soft Anti-passback:
        1) Initially (Time 0) all cardholders are reset to Area 0.
        2) Any cardholder shall enter a controlled area any time after Time 0 by presenting a badge to a SMS entry card reader.
        3) A cardholder shall not exit the controlled area unless he or she has entered the area presenting a badge to the SMS entry card reader.
        4) A cardholder shall not enter the controlled area a second time unless the cardholder has exited that area previously.
        5) A cardholder shall be able to enter through any entry card reader and exit through any exit card reader of a single controlled area.
        6) These options shall include a “forgiveness” Administrator to reset the anti-passback of all cardholders to Time 0 Area 0, either through a manual override or a timezone command.
        7) The SMS shall provide an anti-passback exempt option for privileged or VIP (Very Important Person) cardholders. Cardholders with this option will not have anti-passback rules applied to them.
        8) The SMS shall also have a “forgiveness” feature that will allow the System Administrator to reset the anti-passback of an individual cardholder to Time 0 Area 0.
    b. Timed Anti-passback Feature: Permits the System Administrator to decide how long after a cardholder has swiped their badge that they will have to wait before the same badge will be accepted again at the same card reader. This helps prevent multiple swipes by an individual to allow access to others through turnstile doors.
    c. Two Person Control Feature: Provided to restrict access to certain areas unless there are two (2) cardholders present. This restricts individuals from being alone in restricted or highly secure areas. When an area is configured for Two Person Rule, the following criteria shall prevail:
        1) The card reader shall grant access only if two (2) valid cardholders (with authorized access levels) swipe their badges one after the other. In the event that a second authorized card is not presented within 10 seconds of the first authorized badge, the card reader shall reset and the first card will have to be swiped again. 2) Once two (2) people occupy an area, individual access shall be granted. 3) Individual exit shall be permitted until an area is occupied by only two (2) cardholders at which point the Two Person Rule applies for exit.
    d. Designated One Person Control: The SMS shall allow for a special One Person Mode. This mode shall require that a designated cardholder is present before anyone else is allowed to access a certain area. This restricts individuals from accessing a restricted or highly secure area when not accompanied by the designated cardholder. When an area

is configured for One Person Mode, the following criteria shall prevail: 1) The card reader shall grant access only if the designated cardholder (with authorized access level) swipes their badge.

2) Once the designated cardholder occupies an area, individual access shall be granted normally.

3) Individual exit shall be permitted until an area is occupied by only the designated cardholder, once the specific cardholder leaves, the area will again require the specific cardholder to be present before any other individual is allowed to gain access.

e. Designated Two Person Control: The SMS shall allow for a special Two Person Rule to restrict access to certain areas unless there are two (2) cardholders present and they are 78F<:A4G87 4 FC86<4? R-84@ &8@58ES 7<FG<A6G<BA. -;<F Eestricts individuals from being alone in restricted or highly secure areas as well as restricting the type of personnel allowed in a certain area. When an area is configured for the Designated Two Person Rule, the following criteria shall prevail:

1) The card reader shall grant access only if two valid cardholders (with authorized access levels and special Team Member distinction) swipe their badges one after the other. In the event that a second authorized card is not presented within 10 seconds of the first authorized badge, the card reader shall reset and the first card will have to be swiped again.

2) Once two (2) people occupy an area, individual access shall only be granted to other cardholders who have been designated the Team Member special distinction.

3) A Second designation, “Supervisor” can be assigned to other cardholders. Cardholders with the Supervisor designation shall be announced by means of a contact closure then their card is presented at the entry reader of the restricted area. The occupants of the restricted area may then choose to grant access to the supervisor by closing an external contact connected to the reader interface module, which will in turn energize the door strike output. Closing this contact at any other time shall not open the door.

4) Individual exits shall be permitted until an area is occupied by only two (2) cardholders with special Team Member distinction at which point the Designated Two Person Rule applies for exit.

g. Occupancy Limit Feature: Restricts the number of cardholders that shall be present in an area at any given time. The Occupancy Limit area shall be able to be defined by the System Administrator to limit up to 65,000 cardholders to be in that area at any given time. Once the occupancy limit has been reached, a cardholder must swipe out of the exit card reader before the next cardholder may enter. Each area for which Occupancy Limit is enabled shall be definable with up to 64 entry or exit card readers. Multiple Occupancy Limit Areas shall be definable.

15. Interlock group readers
16. The SMS shall have Interlock support. In the Anti-passback area, there shall be an option to make an area an interlock area. Interlocked areas shall be able to be configured, allowing only one door to be opened at a time within the area. This function shall only be able to be enabled for local anti-passback and shall be unavailable for global anti-passback.
17. The SMS shall support interlocking group readers. As soon as one door's strike is energized or door is open in the group, all other doors will be denied access until a condition is met.

When the SMS USER creates an area with the Interlock set, when one door strike of the area is active or if the door is open, then no door shall be allowed to open and there shall be an alarm.

18. There shall be an alarm for when access is denied due to interlock reader group. There shall be the alarm, "interlock Area Busy," that shall show up when trying to get access from a card. There shall be the alarm, "Exit Request Denied: Interlock Area Busy," that shall show up when pressing the REX button on the panel. There shall be the alarm, "Cannot Open Door: Interlock Area Busy," that shall show up when opening a door from the SMS's Alarm Monitoring application. All alarms shall have a priority of 100 in the SMS's System Administration application.
19. Field Hardware Configuration: All field hardware configuration windows shall be accessed from either the SMS Icon Toolbar or from menu options in the menu bar within the SMS configuration module of the software. When a field hardware device is configured, the device shall appear in the graphical system overview tree and in all appropriate forms.
    a. Configuration of Intelligent System Controllers (ISCs), Input Control Modules (ICMs), Output Control Modules (OCMs), and card readers shall be provided in a Windows format and shall include the following features:
    b. A tab format to logically group information into a series of forms within an icon or menu option. This shall allow for ease of configuration. For example, all forms that relate to the configuration of card readers shall be grouped together in the 'Card reader' icon.
    c. Drop-down lists to define features
    d. Check boxes
    e. Spin buttons
    f. Browse Buttons for ease of locating client workstations
    g. Sortable Lists
    h. Graphical System Overview Tree controls for ease of navigation and use
    i. The SMS shall have the ability for bulk add, modify, and delete privileges for ISCs and card readers to allow for the ease of addition and maintenance of these field hardware devices.
20. The SMS shall provide the ability to search large lists of devices for a string or substring in the device name.
21. Alarm Masking Groups: Support a group alarm masking feature whereas System Administrators shall be able to create groups of alarm inputs that enable them to mask or unmask multiple Input Control Module inputs and card reader inputs simultaneously. The following events shall have the ability to be part of an alarm masking group:
    a. Input Control Module Events
        1) Alarm Input Active
    b. Card Reader Events

1) Auxiliary Input Active
    2) Denied Count Exceeded
    3) Door Contact Tamper
    4) Door Forced Open
    5) Door Held Open
    6) Card Reader Input Tamper

c. Alarm Masking Groups shall be able to be masked as a group or as individual points.

d. Alarm Masking Groups must support the ability to be masked multiple times. Alarm Masking Groups shall be able to be masked and/or unmasked via alarm monitoring commands by guards, via card reader keypad function keys, or via global linkage commands.
e. The SMS shall support "Two Man Control" for masking Alarm Masking Groups.
f. The SMS shall support an Alarm Masking Group status change (Masked to Unmasked or Unmasked to Masked) action to be linked to a function list that is capable of performing many system actions, such as activating a relay output. The SMS shall support a minimum of 64 Alarm Masking Groups per Intelligent System Controller with a minimum of 200 alarm inputs per Alarm Masking Group.

22. Global Input or Output or Event Linkage:
    a. Support a global linkage feature whereby any input or output or event shall be linked to any other input or output or event in the SMS. Input or Output Linkages shall be able to span across Intelligent System Controllers.
    b. System Administrators shall be able to create global I/O function lists, each consisting of a sequence of actions to be performed, such as changing card reader modes, activating outputs, and opening or closing anti-passback areas. Each function list may include up to six (6) actions.
23. Cardholder Use Limits: Support a Cardholder Use Limit feature that shall allow System Administrators to specify the maximum number of times that a cardholder may use their credential at card readers in the SMS.
24. Extended Individual Door Held Open Times: The SMS shall support Extended Individual Door Held Open Times that allows a card reader's door to be held open for an extended period of time beyond the pre-determined standard held open time on a per cardholder basis. The extended held open time shall be user-definable up to 131,070 seconds. Extended held open times shall be set on a card reader by card reader basis.
25. Extended, on Demand, Door Held Open Times:
    a. Support extended, on demand, door held times via a command keypad. The Extended Held Open command configuration shall consist of a command key sequence that shall be from 3 to 6 keys used to enter the number of minutes to extend the door held open time (up to 999 minutes) and a pre alarm time (from 0 to 30 minutes).
    b. Only those cardholders having Command Authority at a given card reader configured for 'Allow User Commands' shall have the ability to execute the Extended Held Open command at that card reader. The Extended Held Open command shall be available after a valid cardholder has received an Access Grant at the card reader. The cardholder shall have a period of fifteen seconds after the Access Grant to enter the extended held open command sequence.

26. Graphical System Overview Tree: Displays a graphical representation of all field hardware (including ISCs, fire panels, intrusion detection devices, personal safety devices, intercom systems, and central station alarm receivers), digital video hardware, access levels, timezones, access groups, holidays, and card formats that have been configured in the SMS. System Administrators shall be able to modify a device that is depicted on the graphical system overview tree or see its properties by double-clicking on the icon and the SMS shall bring them to the appropriate form.

27. Pre-Alarm: The SMS shall support a pre-alarm feature at the card reader. The pre-alarm will sound a tone at the card reader prior to the door held open alarm. The pre-alarm setting shall be configurable for up to a maximum of 131,070 seconds (2,184.5 minutes or 36.4 hours).
28. Alarm or Event Logging:
    a. All alarms and events in the SMS shall by default, always be recorded in the database. The SMS shall give System Administrators the ability to select on a timezone basis, the times that they require the SMS to log specific events to the database.
    b. System Administrators shall have the option for Alarm or Events to be set to log or not to log particular alarms or events on any individual reader and or input.
29. Scheduling Utility:
    a. An integral Scheduling Utility shall be provided. The Scheduling Utility shall allow System Administrators to schedule actions to occur on a one-time or a recurring basis. Recurring schedules shall be configured to begin immediately, last indefinitely, or have optional start and end dates.
    b. The Scheduling Utility shall be available from both the System Administration and Alarm Monitoring applications.
    c. The types of actions that shall be schedulable include but are not limited to:
        1) Action Group
        2) Event Archiving or Purging
        3) Arm or Disarm Area
        4) Start of Guard Tour
        5) Execution of Data Exchange Scripts
        6) Activate, Deactivate, Pulse Device Output and Device Output Groups
        7) Global Anti-Passback Reset
        8) Download Firmware to ISCs and IP Cameras
        9) Download Firmware to Lenel Network Video Recorders (LNVR)
        10) Download Database to ISCs
        11) Execute Function List
        12) Mask or Unmask Inputs, Input Groups, Alarm Mask Groups, Door Forced Open or Held Open
        13) Open Door, Open Door Group
        14) Change Reader Mode
        15) Automatic Reports
        16) Reset Use Limit
        17) Move Bulk Badges from an Area
        18) Deactivate Badges
        19) Logout Visitors
        20) Schedule PTZ Presets
    d. The Scheduling Utility shall maintain a history log in the database for actions that it executes.
30. Multiple Card Formats: Support an unlimited number of card formats. Magnetic stripe and Wiegand card formats shall be supported. Each ISC shall support a minimum of eight (8) access control card formats and if applicable, eight (8) asset formats. As such, each card reader shall also be able to support a minimum of eight (8) access control card formats. If applicable, asset readers shall be able to support a minimum of eight (8) access control card formats and eight (8) asset management card formats. The SMS shall support any magnetic

stripe format that uses card number, facility code, and issue code combinations with a maximum of a nine digit card number and two digit issue code. The SMS shall support any industry standard Wiegand card format.

31. Card Reader Cipher Mode: Support a card reader Cipher Mode that shall allow authorized cardholders to enter their Badge ID by typing it into a card reader keypad, thus emulating the presentation of the credential to the card reader.
32. Denied Access Attempts Counter: Support a denied access attempts count on a per card reader basis. The "Denied Attempts Count" value shall be configurable from 0 to 255. The following access denial types shall cause the current denied count to be incremented: a. Unknown PIN entry at a card reader configures as 'PIN or Card' mode
    b. Invalid cipher entry at a card reader in Cipher Mode
    c. Invalid PIN entered for a given card at a card reader configured 'Card and PIN' mode
    d. Non-matching biometric presented for a given card at a card reader in biometric verify mode.
33. Card Reader Timezone Overrides:
    a. Allow for the pre-defined default card reader settings to be overridden or temporarily changed on a timezone basis. At the beginning of a selected timezone, the selected card reader's operational mode shall be modified from its default mode to any one of the following modes: locked, unlocked, facility code, card only, card or PIN, card and PIN, card and Biometric, card or PIN and biometric, and/or card and PIN and biometric. The aforementioned options shall be available depending on the type of card reader utilized.
    b. Each card reader shall have the ability to have multiple timezone setting overrides assigned to them as required by the System Administrator.
34. Online Context-Sensitive Help: Provide online context-sensitive help files to guide System Administrators and System Operators in the configuration and operation of the SMS. The help menu shall be available from any window in the SMS by pressing the F1 function key or clicking on the Help icon in the toolbar. Help windows shall be context-sensitive so System Administrators can move from form to form without leaving the help window. The SMS shall also come with complete online documentation on the product disc.
35. Monitor Zones:
    a. The SMS shall provide System Administrators the ability to segment their access control SMS field hardware devices into various zones or areas where alarm monitoring client workstations will monitor. These zones shall be assigned an alphanumeric name using up to 128 characters.
    b. The SMS shall allow subset relationship devices (such as card readers or ICMs to Intelligent System Controllers) to be automatically part of the monitoring zone when an ISC is selected AND it shall allow the System Administrator to define which subset devices (card readers, ICMs, etc.) belong to that monitor zone.
    c. Updating of monitor zones shall take place in real time and without requiring operators to re-login.
36. Advanced Field Device Control: The SMS shall allow a System Operator to monitor all alarms in their assigned monitor zone, but only be capable of performing field device control actions on specified devices in the assigned monitor zone. The SMS shall allow System Administrators to set permission control for individual devices within a monitoring zone for command override. The list of permissions for control under the monitor permission groups shall include the following: a. Access modes

b. Open doors
c. Relay and reader outputs
d. Set panel clock
e. Mask alarms and inputs
f. Unmask alarms and inputs
g. Mask alarm mask groups
h. Unmask alarm mask groups

i. Execute function lists
j. Paging
k. E-mail
l. Panel dialup
m. Standalone test mode
n. Download firmware
o. Arm areas
p. Disarm areas
q. Silence area alarms

37. Alarm or Event Routing:
    a. The SMS shall be capable of allowing System Administrators to route alarms and events to various alarm monitoring client workstations on the network. The SMS shall allow any alarm or event to be routed to one or multiple client workstations on the network regardless of where the alarm is generated in the field. Alarms shall be routed to client workstations on a device by device level.
    b. The SMS shall be capable of automatic re-routing of an alarm from workstation X to workstation Y if the alarm is not responded to within a user-definable time period.
    c. The SMS shall implement network synchronization that in the event alarm or event is routed to multiple client workstations, once the first client workstation 'grabs' the alarm, the alarm or event shall be cleared from all other client workstations. As such, alarms that are routed to an alarm monitoring client workstation which does not have a System Operator logged in shall be queued so that all unacknowledged alarms will report to that client workstation once a System Operator has logged into the SMS. Alarms or Events shall be routed based on default settings or timezone control.
38. Text Instructions: Allow for a set of text instructions to be associated with each alarm that arrives into the SMS. The text instruction function shall allow the System Administrator to enter a minimum of 32,000 characters of text for procedures to follow for each alarm that arrives at the alarm monitoring client workstations. Each alarm or event in the SMS shall have its own unique set of text instructions should the System Administrator desire. 39. Alarm Attributes: The System Administrator shall have the ability to configure how the SMS handles the annunciation of alarms on an individual basis. Each alarm and/or event shall have the option(s) to:
    a. Display at one or more alarm monitoring client workstation.
    b. Allow higher priority alarms to be displayed on the alarm monitoring client workstation ahead of lower priority alarms.
    c. Require the field device, which generated the alarm to be restored to its normal state before the alarm is cleared.
    d. Print the alarm to the local event printer.
    e. Have a customized voice message annunciate at the client workstation.

f. Have the alarm breakthrough to the alarm monitoring window should the System Operator be working in another application.
g. Allow System Operators to change the journal entry once the alarm has been acknowledged.
h. Insure that the alarm will not be able to be deleted from the alarm monitoring window upon acknowledgment.
i. Display text and audio instructions outlining the procedures to follow when responding to the alarm.
j. Automatically call-up associated maps.
k. Automatically call up the associated cardholder record.
l. Automatically call up the associated cardholder photo using the video verification function.
m. Require a password to view the alarm.
n. Require a password to acknowledge the alarm.
o. Require acknowledgment to clear.
p. Allow mandatory journal entry upon acknowledgment.
q. Use pre-defined journal entries for alarms.
r. Select the option for journal entry based upon the specific alarm.
s. Automatically send an e-mail message.
t. Automatically send an alphanumeric page.
u. Have the alarm appear on the alarm monitoring window with a flashing colored coded bar across the alarm for high priority alarms.
v. Have the alarm, when acknowledged, display an alternative flashing color coded bar across the alarm than for the original alarm color.
w. Trigger a function list(s) when the alarm is acknowledged. x. Require User Logon for Acknowledgment

40. Alarm-Event Mappings: The SMS attributes in Alarm Attributes shall be assignable on a 'global' basis to all devices that share an alarm description. Thus, the 'door force open' alarm attributes shall apply to any door with a card reader that is forced opened in the SMS. The SMS shall have the capability to assign a unique group of alarm attributes to specific device or alarm combinations to override the global settings for specific case settings. For example, System Administrators may assign a different set of attributes to be applied to a 'door force open' at a bank vault or research facility than they would if the front door was forced open. The SMS must include this type of flexibility. Each device or alarm combination shall have the ability to have its own unique attribute set if the System Administrator desires.
41. System Downloads:

a. The SMS shall provide for the downloading of data to the ISCs. Downloads shall load SMS information (timezones, access levels, alarm configurations, etc.) into the ISCs first, followed by cardholder information and card reader configurations.
b. All ISCs on the SMS shall be capable of either full or selective downloads to individual Intelligent System Controllers and bi-directionally so that alarms will still report to their respective alarm monitoring client workstations as cardholder information is being downloaded.
c. A complete database download of 10,000 cardholder records to all ISCs (regardless of the number of ISCs) must be complete within ten (10) minutes.

d. Information on cardholder status, badge status, timezones or access levels shall download in real time as they are added, modified, or deleted from the SMS.

42. Card Reader Options: Include the following options for each reader on the system:

a. Allow User Commands
b. Rename Auxiliary Inputs
c. Rename Auxiliary Outputs
d. Independently Supervise REX and DPS
e. Configure REX and DPS as Normally Open or Normally Closed
f. Deny if Duress
g. Assume Door Used h. Alarm Masking
i. Activate Outputs
j. Two Card Control
k. Checkpoint
l. Do Not Activate Strike on REX
m. The ability to allow System Administrators to determine on a timezone basis to log or not to log on a card reader by card reader basis:
    1) Access Grants
    2) Access Denied
    3) Card Reader Status Alarms.
n. Allow for user-definable door strike functionality for each card reader in the SMS.
o. Allow for each card readed to be selected as either an ‘in’ reader, ‘out’ reader, or ‘none’ to allow for ease of reporting time and attendance basic ‘time in’ and ‘time out’ data.
p. Enforce Use Limit: This option shall enable Card Use Limits at the card reader limiting the number of times that cardholders may use their credential to gain access at the card reader.
q. Alarm Shunt: The SMS shall have the ability to shunt a door contact of separate intrusion detection systems. When the SMS provides an access granted a dedicated auxiliary output shall first trigger and bypass the door contact of the separate intrusion detection system, and then the door locking mechanism shall unlock. Once the door returns to a secure state the door contact of the separate intrusion detection system shall return to its normal state.
r. Supervise Door: Sets the SMS so that the card reader door contact is wired as a supervised input.
s. Relaxed door forced open detection: The SMS shall provide an option that when selected shall allow for the door to be opened for an additional three (3) seconds time period after the request-to-exit sensor has been returned to the normal state.
t. Allow for one (1) or more access points in a specified area to be armed and disarmed directly from the Command Control Keypad.

43. Input Control Module (ICM) Options: Provide the following options for the Input Control Modules:

a. Alarm Masking: The ability to mask the alarm input on a timezone basis.
b. Local Linkage: The ability to locally link outputs with inputs that are attached to the same ICM or Output Control Module (OCM).
c. Activate Output: The ability to activate an output tied to the ICM or OCM on a timezone basis.
d. Activate Output Always: The ability to activate an output always.

e. Configuration of Debounce Times: The ability to control the amount of time that an input state change must remain consistent in order for it to be considered a real change of state.
f. Configuration of Hold Times: When configuring an Alarm Input, a hold time setting shall be settable from 0-15 seconds.
g. Checkpoint: The ability to configure an input as a designated stop on one or more guard tours.
h. Supervised Input: The ability to specify if a specific alarm contact on the ICM is a supervised or unsupervised contact.

44. Entry or Exit Delay: The ability to set up entry or exit delays for inputs that are attached to any ICM, SRI, or DRI. System Administrators shall have three options for entry or exit delay:

a. Non-Latched Entry: When an input activates, the alarm will not be reported until the Entry delay expires. If the input is still active when the entry delay expires, the alarm will be reported. If the input is not active when the entry delay expires, then the alarm will not report.
b. Latched Entry: When an input activates, the alarm will not be reported until the Entry delay expires. If the input is still active when the entry delay expires AND the alarm has NOT BEEN MASKED, the alarm will be reported. If the input has been masked when the entry delay expires, then the alarm will not report.
c. Exit Delay: When an input activates, the alarm will not be reported (operates as if masked) until the Exit delay expires. If the input is still active when the exit delay expires, the alarm will be reported. If the input is not active when the exit delay expires, the alarm will not be reported.

45. Intelligent System Controller Options: System Administrators shall have the ability to group add, modify, and delete Intelligent System Controllers (ISCs) in the SMS. The SMS shall have a copy command, allowing System Administrators to easily and efficiently add ISCs. The copy command will copy all information configured for an ISC selected and apply those same characteristics to the new ISC being added. System Administrators shall apply those same characteristics to the new ISC being added. System Administrators shall also have the ability mark ISCs as ‘online’ or ‘offline’ depending on whether those panels are online. The SMS shall also prompt the System Administrator if the System Administrator attempts to configure the number of cardholders (and assets, if applicable) that will be downloaded to an ISC to a number greater than that which the ISC’s memory can handle.
46. Strike Follower
47. An output for a reader can be overridden so that it is configured to activate and deactivate timed with a door strike. It can be set for a delay time and/or pulse.
48. There shall be a mode called "Strike Follower". The mode shall be optional and mutually exclusive with alarm shunt and tailgate. Strike Follower shall override the auxiliary 1 output and shall allow the output to follow the strike pulse. It shall be configurable with a delay and a pulse time.
49. The settings shall include:

a. Activation delay
b. Mode: Pulse or Follower
c. Pulse time: When pulse is used, a pulse time can be specified.

50. Alarm Monitoring - Alarms Monitored: When the SMS is configured, the System Administrator shall assign a default monitor zone to be monitored. The monitor zone shall include default alarm types with default timezones of which the alarm type will be monitored. These monitor zones will then be assigned to an alarm monitoring client workstation. The SMS shall allow for the monitoring of a combination of one or more ISCs, ICMs, alarm inputs, alarm outputs, and card readers. If applicable, the SMS shall also allow the monitoring of a combination of digital video recorders, video cameras, fire alarm panels, intrusion detection devices, central station alarm receivers, intercom exchanges, intercom stations, and personal safety panels. System Administrators shall have the option to define monitor zones to include all sub devices of an ISC and/or digital video recorders or to choose which sub devices of an ISC and/or digital video recorder belong to that monitor zone. Alarm monitoring client workstations shall be configured to annunciate any or all of the following types of alarms: access granted alarms, access denied alarms, system alarms, emergency alarms, and/or area control alarms.
51. The SMS shall allow for automatic update of the list of hardware devices as they are added, modified or deleted from the SMS. Newly configured devices and changes to existing devices shall be reflected in the hardware list automatically. The SMS shall indicate a deleted device by changing the icon and text associated with the device. Upon the next login, the SMS shall remove the device from the hardware tree.
52. Alarm Annunciation Configuration: The System Administrator shall have the capability to configure how the SMS handles the annunciation of alarms on an individual alarm or event basis. Each alarm and/or event shall have the option(s) to: a. Display on the alarm monitoring client workstation.
    b. Allow higher priority alarms to be displayed on the alarm monitoring client workstation ahead of lower priority alarms.
    c. Require the field device that generated the alarm to be restored to its normal state before the alarm shall be cleared from the alarm monitoring window.
    d. Print the alarm to the local event printer.
    e. Have a customized voice message annunciate at the client workstation.
    f. Have the alarm breakthrough to the alarm monitoring window should the System Operator be working on another application on the alarm monitoring client workstation.
    g. Allow System Operators to change the journal entry once the alarm has been acknowledged.
    h. Require that the alarm not be deleted from the alarm monitoring window upon acknowledgment.
    i. Display text and audio instructions outlining the procedures to follow when responding to the alarm.
    j. Automatically call-up associated maps upon arrival.
    k. Automatically call up the associated cardholder record with photo when the alarm displays.
    l. Automatically call up the associated cardholder photo in the video verification function when the alarm displays for comparison to a live video image at the card reader.
    m. Automatically call up live video from a digital CCTV camera to view the area in alarm
    n. Allow the System Operator to control digital CCTV camera functions including pan, tilt, zoom, focus, and iris controls.
    o. Require System Operators to enter in a password to view the alarm.
    p. Require System Operators to enter in a password to acknowledge the alarm.

q. Require System Operator acknowledgment to clear.
r. Allow mandatory journal entry upon acknowledgment.
s. Have pre-defined "canned" journal entries for alarms in the SMS.
t. Allow non-essential events to be cleared without requiring System Operator journal entry, while other alarms shall require System Operator journal entry.
u. Automatically send an e-mail message to one or more e-mail recipients.
v. Automatically send an alphanumeric page to one or more pagers.
w. Have the alarm appear on the alarm monitoring window with a flashing colored bar across it for high priority alarms based on its priority. Each priority in the SMS shall have its own unique color assigned to it. A minimum of 255 colors must be available for assignment to a minimum of 255 priority levels.
x. Have the alarm, when acknowledged, display a different flashing colored bar across the alarm than for the original alarm color. Each acknowledged priority in the SMS shall have its own unique color assigned to it. A minimum of 255 colors must be available for assignment to a minimum of 255 priority levels.
y. Insert and display alarms based on sort order. System Operators can sort on alarms based on alarm priority, time, date, alarm description, card reader, alarm input device, ISC, cardholder, and if applicable, asset scan ID, asset name, intercom station, central station alarm receiver, transmitter, or transmitter input. All sorts MUST be able to be accomplished in one mouse click.
z. Allow the System Operator to be able to find the location of the alarm by using a graphical map, the real-time graphical system status tree, or an alarm menu. A map callup feature must be provided that will show the map associated with the alarm. aa. Have a function list(s) assigned to it that will trigger when the alarm is acknowledged.
bb. Require User Logon for Acknowledgment P This feature shall require a user ID and password to be entered when the given alarm is acknowledged. This ID shall be different than the User ID that is currently logged onto the SMS.
cc. Activate an Action Group P This feature shall allow the System Operator to execute an action group, which shall include one or more actions.

53. Alarm Handling: The handling of alarms shall resemble the following steps.

a. The System Operator shall select the alarm or event by any one of the following procedures:
    1) Clicking with the mouse on the system device map icon representing the alarm
    2) Choosing acknowledge from the menu bar
    3) Highlighting the alarm or event in the alarm list by clicking the mouse
    4) Double-clicking on the alarm or event in the alarm list box
b. Any of the above choices shall put the System Operator in the acknowledgment window. The acknowledgment window shall display the time, date, and a user-defined description of the alarm, as well as any emergency procedures. The acknowledgment window shall present the System Operator with the following choices:
    1) Review instructions or procedures to follow for the alarm
    2) Make a journal entry
    3) Acknowledge the alarm
    4) Listen to audio instructions
    5) Print the alarm and instructions to a local printer
    6) Review any previous journal entries for this alarm.

54. Until the alarm is acknowledged, the alarm shall remain in the Main Alarm Monitoring Window and be counted in the alarm status line.
55. System Operators shall have the ability to mark an alarm as 'In Progress', meaning that a System Operator has recognized the alarm and is working on a response. When an alarm is marked as 'In Progress', the SMS shall silence any repeating audio notifications on any Alarm Monitoring Workstation in which the alarm was routed and also remove the alarm sprite notification on any graphical maps that may be displaying the alarm. Other System Operators shall be notified that an alarm has been marked as 'In Progress' by an icon next to the alarm in the Main Alarm Monitoring Window.
56. Control of the associated field hardware device from which the alarm was generated through a right-mouse click operation shall be available. For example, a System Operator can open a door via a card reader alarm. All field hardware device icons on any screen can control the associated field hardware through a right-mouse click operation. A right-mouse click will invoke a menu item with all available control options for that hardware device.
57. System Operators shall have the ability to delete the alarm from the alarm monitoring window without acknowledging the alarm. This feature is useful when guards are monitoring access grants to track where cardholders are moving throughout the facility, but do not necessarily want to acknowledge the alarm.
58. The SMS shall provide a text entry field for the System Operator to enter a journal detailing the cause of specified alarms and the actions taken. The journal shall be mandatory for certain alarms or events per the System AdministratBEUF 7<F6E8G<BA. -;8 journal shall allow System Operators to enter an unlimited amount of notes. Choosing Acknowledge from this window shall clear the alarm indicator and store the alarm information and journal to the database.
59. Other alarms shall be displayed by the SMS while any alarm is being addressed. If another alarm occurs, the alarm pending counter shall increase by one and the new alarm shall enter into the alarm list box prioritized in a sort order as defined by the System Operator. Up to 255 alarm priorities shall be available.
60. The SMS shall allow journals to be retrieved, viewed, and edited on screen to provide the System Operator with the ability to complete unfinished journal entries. Journals shall be saved to the database and to a tape during database backups for a permanent record as required by CUSTOMER regulations.
61. For card reader alarms, the SMS shall allow System Operators to activate, deactivate, or pulse any or all of the card reader outputs configured and associated with the card reader. The System Operators shall also have the ability to mask or unmask each individual card reader door forced open alarms, door held open alarms, and either or both or the auxiliary alarm inputs configured and associated with the card reader.
62. Current Status Indication: The alarm monitoring window shall provide a visual status that displays the current status of all devices in the device tree including child devices downstream from the primary device. Additionally there shall be a numeric display of card readers, ISCs and ICMs that are offline.
63. Pending Alarm Windows: The SMS shall support a Pending Alarm Window in the Alarm Monitoring Workstation. This shall be a separate window from the Main Alarm Monitoring Window that shall be opened at any time to view a list of only pending alarms. The Pending Alarm Window shall be optionally displayed in conjunction with the Main Alarm Monitoring Window. The Pending Alarm Window shall continuously update as new pending alarms are generated and as existing pending alarms are acknowledged or deleted.

Pending alarms shall also display in the Main Alarm Monitoring Window. The Pending Alarm Window shall operate and function in the same manner as the Main Alarm Monitoring Window described throughout this document.

64. Device Group Support: Support device grouping for uniform command and control of groups of devices within the system. Four types of homogeneous device groups shall be supported:
a. Card Reader Groups
b. Input Groups
c. Relay Output Groups
65. Color Coding for Alarm Priorities: Display alarms in the active alarm monitoring window with a flashing colored bar across the alarm based upon priority. Acknowledged alarms may be set with alternate color-coding. A minimum of 255 colors must be available for assignment to a minimum of 255 priority levels.
66. Highlighting of Unacknowledged Alarms: The SMS shall allow for unacknowledged alarms to automatically be displayed in a pop-up window after a user-defined amount of time. The user-defined amount of time shall be set in System Administration.
67. Pre-Defined “Canned” Alarm Acknowledgement Responses: Have the capability for pre-defined alarm acknowledgment responses for alarms in the SMS. An unlimited number of pre-defined responses shall be able to be configured for each alarm in the SMS.
68. Cardholder Record Call-up: From the alarm monitoring window, the System Operator must be able to display a cardholder record with the stored cardholder’s image This feature shall be user configurable to be automatic meaning that the Cardholder Window will automatically appear on the Alarm Monitoring client workstation on cardholder activity and will display the current cardholder’s information with photo. The Cardholder Window will automatically update with updated cardholder information as additional cardholder activity is generated. This feature shall be provided at all alarm monitoring client workstations to assist the System Operator in determining the access rights of an employee who may have forgotten his or her badge or to verify that the individual presenting the card is the correct individual cardholder. Utilizing a database search via the input of the cardholder's name or other key search field, or by selecting a cardholder record call-up from the main monitoring window on a cardholder alarm, the SMS must access the employee's personnel file, containing pertinent information and the employee's image for identification by the System Operator. The System Operator shall not be required to exit alarm monitoring to view this information and this operation must not restrict the operation of monitoring alarms.
69. In the event of an access denied or access granted card reader alarm signal to the alarm monitoring client workstation, this function shall be available as a menu or mouse selection, based on the alarm event. Data input by the System Operator shall not be required. 70. Inactive Badge Alarm: The SMS shall provide an alarm, indicating current badge status, if An attempt to gain access is made with a badge that’s status is set to any other value other than “Active” in the card holder record. Typical inactive badge status values include “Lost” and “Terminated”. Access shall come with this feature disabled, the System Administrator has the ability to enable this functionality.
71. Request to Exit Event: The SMS shall provide an event when a Request to Exit (REX) is used. By default, the SMS shall come with this feature disabled, the System Administrator has the ability to enable this on a reader by reader basis.

72. Cardholder Photo Verification: From the alarm monitoring window, the SMS shall optionally display the stored cardholder photo for each credential presented at the user specified reader(s). This function shall allow an operator to verify that the person using the credential matches the stored photo. The system operator shall be able to select from a list of readers. As the cardholder badges through the selected reader their photo shall appear in the Cardholder Verification window. The system operator shall be able to open multiple Cardholder Verification windows to cover multiple readers at the same time. If the Cardholder Verification window is open when the Alarm Monitoring application is closed then the Cardholder Verification window shall open automatically next time the application is launched.
73. Cardholder, Card Reader, or any Field Hardware Device Trace: From the alarm monitoring window, the System Operator must be able to initiate several traces of cardholders, assets, and/or field hardware devices while monitoring alarms. This information shall be continuously accumulated in the dedicated trace window until the trace is stopped. The trace operations must not interfere with the operation of the alarm monitoring, and be continuous while alarms are monitored. The results of each trace shall be printable on the report printer or displayed on the screen. The traces shall operate independently, such that one trace may stop and start without interfering with another.
74. Trace windows operate independently of each other and the Main Alarm Monitoring Window. Thus, different Alarm Filter sets shall be settable for each alarm window (Main Window and Trace Windows) open in Alarm Monitoring. For example, the Main Alarm Monitoring Window may not monitor Access Grants Events, while one or more of the trace windows are monitoring Access Grants Events.
75. The operator of the SMSUF A?4E@ &onitoring application shall be able to acknowledge alarms from any alarm view window (even if they are no longer present in the Main Alarm Window). The alarm view windows shall include Main Alarm Monitor, Trace Monitors, Pending Alarms, and Video Verification. The SMS shall allow for individual alarm acknowledgement and fast or group acknowledgement.
76. The SMS shall support historical traces. Historical traces shall allow System Operators to specify the date and time range that they would like displayed for the particular device that is being traced. For example, a System Operator may perform a historical trace that shows the last seven days activity at a particular card reader. Events are then added in real-time during and after the database has been searched for historical events. Historical traces shall also have the ability to be run against restored (previously archived) data.
77. The SMS shall allow System Operators to filter alarm types from the history trace window. Alarms that shall be filtered from the trace window are access granted alarms, access denied alarms, system alarms, duress alarms, and area control alarms. If applicable, alarms that shall also be filtered are asset alarms, fire alarms, intercom alarms, central station receiver alarms, video clips, and transmitter alarms.
78. The SMS shall allow for a trace on any ISC, ICM, Alarm Input, Credential, Intrusion Detection Device, Monitor Zone, or card reader to be performed. If applicable, the SMS shall allow for a trace on any asset, intercom, or camera to be performed.
79. Single-Click or Double-Click Device Command Execution: The SMS shall support the ability to execute a device command based on either a single-click or double-click on the field device icon in the System Hardware Status Tree or Graphical Map. For example, double-clicking a card reader icon shall pulse open the door for the configured strike time.

Whether a single-click or double-click is used to activate the command shall be determined on a System Operator basis.

80. 'On the Fly' New Login of System Operators: Allow a System Operator to login over another System Operator who is already logged into the same client workstation. This process shall log the first System Operator off of alarm monitoring and log the new System Operator on, changing any permissions necessary for that System Operator.
81. Auto Exit to Windows 7 or 2008 or 2003 or XP or Vista Login Window: Configurable to automatically exit the Alarm Monitoring application and log the System Operator out of the Windows 7 or 2008 or 2003 or XP or Vista Operating System when a System Operator logs off an alarm monitoring client workstation. The SMS shall then bring the System Operator to the Windows Login Window for the next System Operator to log on.
82. Grant or Deny Popup Window: The SMS shall have the ability to launch a pop-up window when a request for access is made through global input or output activity, such as when an intercom station is linked to a door. Upon activating the intercom, the pop-up window shall be displayed in the Main Alarm Monitoring Window and the System Operator shall then have the ability to issue a grant or a deny for the open door request.
83. Alarm Monitoring P Column Display and Configuration: Allow System Administrators and System Operators to define which columns are displayed in the Main Alarm Monitoring Window and in which order. System Administrators and System Operators shall also be able to determine the column order.
84. Test Mode: Support a Test Mode for Alarm Inputs, Door Forced Open, Access Grants. Tests on Input Device Groups shall be available to verify that all inputs within the group are operational. Upon entering into Test Mode and for the duration of the test, alarms from members of the group shall either be displayed in a separate window or view on test alarm monitoring client workstations or on all Alarm Monitoring client workstations in which the alarms are usually routed. During the test (the duration of the test shall be set by the System Operator), all inputs within the group are manually activated in the field. At the end of the time duration, a report shall be generated flagging any inputs for alarms that were not received. During the Test Mode, all alarm operations carry on as programmed (that is, Global I/O functions, CCTV commands, printer activity, etc.) so that all functions are tested.
85. Manual Control: Provide the System Operator the option to manually control over all output points or input points connected to the SMS. Control points are defined as any door strike, auxiliary card reader output, or any other relay output point of an Output Control Module (OCM).
86. Destination Assurance: Provide the ability to alert the system operator when a cardholder does not reach a required location and present their credential after entering at a designated checkpoint in a designated period of time.
87. Real-Time, Dynamic Graphical Maps:
    a. Support graphical maps that display device or group status, function lists and video cameras dynamically in real-time. The maps may be configured to appear on command or when specified alarms are selected for acknowledgment. Map device icons shall have the ability to dynamically change shape and/or color to reflect the current state of the device. The SMS shall indicate if the field hardware is not operating with the most current version of firmware.
    b. Support all map formats listed below:
        1) Adobe Photoshop (.psd)

2) AutoCAD DXF (.dxf)
3) CALS Raster (.cal)
4) Encapsulated Post Script (.eps)
5) GEM or Ventura (.img)
6) IBM IOCA (.ica)
7) JPEG (.jpg)
8) JIFF (.jif)
9) Kodak Photo-CD (.pcd)
10) Kodak Flashpix (.fpx)
11) LEAD (.cmp)
12) Macintosh PICT (.pct)
13) MacPaint (.mac)
14) Microsoft Paint (.msp)
15) Port Net Graphics (.png)
16) Sun Raster (.ras)
17) Targa (.tga)
18) TIFF (.tif)
19) Windows Metafile (.wmf, .emf)
20) Windows Bitmap (.bmp, .dib)
21) WordPerfect Raster (.wpg)
22) Zsoft PCS or DCX (.pcx, .dcx)

c. Support user-defined icons for field hardware devices. The SMS shall also give System Operators the ability to affect the mode of card readers, open doors, start a trace on a device, mask or unmask alarm inputs, and activate or deactivate or pulse an output from the map icons.
d. The graphical maps shall have the ability to be printed to a local printer.

88. Real-Time Graphical System Status Tree and List Window: The SMS shall support a real-time graphical system status tree or list window that graphically depicts all field hardware devices that are configured in the SMS. The real-time graphical system status tree or list window shall list all ISCs, ICMs, alarm inputs, relay outputs, and card readers. The SMS shall display if the ISCs, alarm input panels, alarm output panels, or RIMs are not currently operating with the most current version of firmware. If applicable, the graphical system status tree or list window shall also list all digital video recorders, video cameras, and intrusion detection devices, zones, and areas. The tree or list window shall show the real time status of all these devices (online vs. offline, alarms activated, masking status, etc.).
89. The graphical system status tree or list window shall include three counters:
    a. Active Counter- a counter of the number of active points in the Monitoring Zone.
    b. Offline Counter - a counter of the number of offline devices in the Monitoring Zone.
    c. Masked Counter - a counter of the number of masked points in the Monitoring Zone.
90. System Operators shall be able to display both list window(s) and graphical system status tree(s). The List Window shall display all hardware devices separately in their own row in the window. The following columns shall exist in the list window: a. Device Name
    b. ISC or ICM or OCM Name c. Current Device Status
91. System Operators shall be able to sort any column in ascending or descending order. System Operators shall also have the ability to choose what types of devices to display in the graphical system status tree or list window. The following choices shall be available: a. Include All Devices

b. Include Specified Devices
   1) Active devices
   2) Offline devices
   3) Masked devices

92. A status bar indicator shall identify the current selections for the list window or graphical system status tree. System Operators shall be able to display multiple graphical system status trees and/or list windows on a single Alarm Monitoring Workstation.
93. The SMS shall give System Operators the ability to acknowledge alarms from the real-time graphical system status tree or list window without going back into the Main Alarm Monitoring Window. The SMS shall also allow System Operators to affect the access mode of card readers, open doors, start a trace on a device, mask or unmask alarm inputs, and activate or deactivate or pulse an output from the tree icons. The system hardware status tree or list window shall have the ability to be printed to a local printer. The SMS shall also allow System Operators to launch a video player to view live video at the video camera selected.
94. Function List icons shall be able to be placed onto the System Status Tree and thus, System Operators shall have the ability to control and activate function lists from the tree.
95. Alarm Masking Group icons shall be able to be placed onto the System Status Tree and thus, System Operators shall have the ability to view the status of the alarm masking groups and control the groups from the System Status Tree.
96. Anti-passback area icons shall be able to be placed onto the System Status Tree and thus, System Operators shall have the ability to control area status (open or closed) from the tree.
97. Automatic Credential Deactivation by Lack of Use: Have an automatic credential deactivation function where a cardholder's credential will automatically deactivate after an extended period of inactivity based upon a predetermined time period. The credential status may be reset by authorized System Operators.
98. Alarm Filtering: Have the capability for filtering out alarm types from the alarm monitoring window. Alarms that may be filtered are access granted alarms, access denied alarms, system alarms, duress alarms, and area control alarms. If applicable, fire alarms, asset alarms, intercom alarms, central station receiver alarms, intrusion detection alarms, video event alarms, and transmitter alarms may also be filtered.
99. Manual Override of Card Readers: Support System Operator overrides of card readers from the alarm monitoring window, graphical maps or the real-time system status tree. Also support the ability to manually set a reader back to default mode.
100. Alarm Masking:
   a. Support the masking of alarms to be controlled on a timezone basis or by manual control.
   b. Support the ability to configure inputs to be "Unable to Mask".
101. Manual Overrides of Alarm Points and Relay Outputs: The SMS shall support System Operator overrides of alarm points and relay outputs configured in the SMS. System Operators shall have the ability to manually mask or unmask an alarm point and/or activate, deactivate, or pulse a relay output from the alarm monitoring window, the graphical maps, or the real-time graphical system status tree.
102. Online Context-Sensitive Help: Provide online context-sensitive help. The help menus shall be available from any window in the SMS by pressing the F1 function key or clicking on the help icon in the toolbar.

103. Sorting Capabilities: Allow System Operators to arrange the way that alarms and/or events in the alarm monitoring window are listed by sorting the alarms and events. Sort criteria shall be based on priority, time or date, ISC, Card Reader, ICM, Input Device, or Cardholder. Additionally alarms and events can be sorted based on asset scan ID, asset name, intercom station, intrusion panel, transmitter, or transmitter input.
104. Alarm aggregation: Alarm aggregation is a mechanism of combining several alarms into a single item (group) based on certain criteria. The SMS's System Administration application shall have an Aggregate option. A user that has permissions to modify alarms shall be able to enable or disable alarms for aggregation. Alarms shall be aggregated in the Main Alarm Monitoring window if the following criteria are met: a. Alarms are of the same type
    b. Alarms are for the same device
    c. The aggregation option is enabled for the alarm type
105. The group of aggregated alarms shall display the number of alarms in the group as a part of the Alarm Description column if the group contains more than one alarm. Additionally, the alarm description shall be displayed using a bold font. All other columns for the group shall display information for the most recent alarm in the group.
106. The SMS's Alarm Monitoring application's operator shall be able to acknowledge or delete a group of aggregated alarms. When acknowledging or deleting a group of aggregated alarms, all alarms in the group shall be acknowledged or deleted. Acknowledge action shall also involve marking in progress. In case of acknowledgment, the progress bar shall be displayed to indicate the progress of the operation.
107. There shall be a Fast or Group Acknowledge command. If the command is applied to one or more groups of aggregated alarms, all alarms from the selected groups shall be acknowledged or marked in progress depending on what option the user selected.
108. Masking of Successful Command Acknowledgements: The SMS shall support the removal of 'success acknowledgements' that are shown in the Main Alarm Monitoring Window after a command has been successfully executed. The SMS shall allow the successful acknowledgements to be removed on a per System Operator basis.
109. Hardware Update Timer: The SMS shall utilize a hardware update timer whereas the System Administrator can set how often system status updates take place. These updates are reflected in the status bar and the real-time graphical system status tree. This frequency shall be defined in one minute increments and shall be changed 'on the fly' by System Operators. Immediate changes in hardware status are reflected immediately in the real-time graphical system status tree.
110. E-mail Interface Option: Support an e-mail interface seamlessly integrated within the SMS Alarm Monitoring application. System Operators shall have the ability to manually or automatically send ASCII text e-mail messages from the Alarm Monitoring application on demand regarding any alarm currently displayed in the Main alarm monitoring window. E-mails shall have to ability to be sent to multiple e-mail accounts if desired. Integrate with Microsoft Exchange Server.
111. Personnel Management and Enrollment:
    a. The SMS shall generate and store personnel records, as well as monitor badge or credential use throughout the facility. These credentials shall be fabricated at any of the SMS enrollment and badging client workstations configured based on data and images that are input and captured at the time of enrollment. Credential images are to be digitized using industry standard JPEG image compression, and printed using a high quality and direct card printing process.

b. Create and Maintain Cardholder Database: A record for each cardholder shall be created in the badging module of the SMS by entering the required data into appropriate data fields. The System Administrator shall be able to define drop-down list box fields for repetitive entered text (for example: Department, Division, Title, Building Number, etc.). Drop-down list boxes shall allow the System Operator a variety of pre-defined choices for data input. The screen design shall be configurable to allow the entry of data in any format desired. The tab order shall be configurable, and the cardholder ID field of up to 18 digits shall be optionally generated by the SMS from either manual System Operator entry, automatic selection of the next available ID, or by use of the cardholder's social security number.
c. Once all fields have been entered, the SMS shall store the applicant's record to the SMS database. These records must be stored in a central database. Updating cardholder data shall be possible at any time by any authorized System Operator. The SMS shall havea field that allows System Administrators to view the last date and time that a cardholder's record has been modified, without running a report. The cardholder form must be user-definable to allow System Administrators to layout the cardholder form.
d. A SMS data import function shall be available to pre-load the SMS with personnel records and industry standard image formats. This import function shall be capable of adding records to the database at any time.
e. The database shall have key fields that are sorted in an index to allow for faster searches. The System Administrator shall be able to designate fields as required and/or unique fields. No record shall be added to the database that does not contain information within the required fields. No record shall be added to the database that contains a duplicate value in a field that was designated as a unique field.
f. Only System Operators with delete privileges (assigned by the System Administrator) shall be able to delete records. Deleting a record shall permanently remove the record from the database (including image files) to free up the disk space for further use.
g. The System Operator shall have the following functions available when enrolling cardholders: choose a badge type, select access levels, enter personal identification numbers (PIN), and/or any other user-defined fields. The SMS shall allow System Administrators the ability to set a default issue code for all first time prints of credentials. The SMS shall also allow System Administrators the ability to auto increment the issue code each time a new Badge is created or to have the System Operator manually enter in a unique issue code each time a new Badge is created. The SMS shall support a minimum of two digits for the cardholder ID issue codes.
h. The SMS shall utilize keyboard or mouse commands that allow System Operators to quickly create a record for any person. The System Administrator shall be able to define drop-down list box fields for the badge type being issued and default values for the other fields based on the badge type.
i. The cardholder form shall also have the option of displaying a cardholder's signature for the record. The cardholder's current Badge information shall also be displayed on the cardholder form complete with Badge ID number, issue code if applicable, activation and deactivation date and time, and the number of times the current badge has been printed.
j. The cardholder form shall also have the ability to display the cardholder's stored images in one of two ways.

1) Photo Display - This option displays the optimum quality photo using the JPEG compressed image stored in the SMS database.
2) No Photo - This option does not show a cardholder photo.

k. The cardholder form shall also display cardholder 'Last Access' information. This field will show the last card reader that the cardholder accessed or attempted to access, complete with a time and date stamp.

112. Modify Existing Field Names of SMS Cardholder Form: The SMS shall provide a method of defining basic user-defined fields. It shall allow System Administrators to rename the standard database fields in the cardholder form of the SMS and move the fields to different locations on the form. Additional functionality shall be available in the advanced Forms Designing and Editing Module.
113. Cardholder Active Badges: A cardholder may possess one or many badges at any one time.
114. If a badge is updated or re-issued, the SMS shall guide the System Operator to first change the existing badge's status to the appropriate classification (de-activate) before a re- issue of the new badge occurs.
115. By utilizing the previously captured image and employee record, the SMS must allow for fast and efficient re-issuance of a badge. As this re-issued badge is printed, the SMS shallupdate its database to remove access rights from the old badge number and activate the new badge number.
116. Each cardholder record shall offer a user-definable activation and expiration date field. The activation date shall be changed by a System Operator to establish a future activation date. A System Operator shall be able to re-activate a card that has been previously de- activated.
117. When issuing a new badge to a cardholder, System Operators shall be able to assign the pre-existing badge deactivation date and time to the badge instead of the default deactivation date and time for new badges. The deactivation date and time may be assigned on a per badge type basis.
118. A badge form will keep a complete history of every badge that was assigned to the cardholder's issue code, badge type, badge status, activation and deactivation dates and times, PIN numbers, embossed numbers, and anti-passback information.
119. Badge status deactivate
120. All active badges can be configured to change to another badge status when the deactivate date has passed. It is possible to configure this system-wide or per badge type. The badge status shall change 24-48 hours after the deactivate date.
121. Multiple Active Badges: The SMS shall support a user configurable Multiple Active Badge feature. This shall allow cardholders in the System to have up to a user-defined pre-determined number of badges active in the SMS at any one time. System Administrators shall have the ability to set the maximum number of active badges allowed in the SMS.
122. Assign Access Levels: At the time a badge is created it shall be possible to have up to 128 access levels assigned to the cardholder's convenience, the System Administrator must be able to define default access levels to be assigned for given badge types. If a System Operator has proper authorization, cardholder access levels shall be modified. When a badge is created with access rights, or modified, that change shall be downloaded to all ISCs immediately upon completion of the change. Record changes for access rights shall affect only the modified record, and shall not require a download of the entire cardholder database.

123. The access changes shall be downloaded to the field hardware as soon as the employee record change is complete. This badge record download shall not effect field hardware operations.
124. When a badge reaches its deactivation date or time the SMS shall automatically deactivate the access rights associated with the badge. All access rights of a badge shall be eliminated after the expiration date. Should the cardholder become authorized for access again, new access rights shall be applicable to the same badge, and re-issue shall not be required. Should an expired cardholder swipe his badge after his card has expired, access shall be denied and an "invalid credential" alarm event shall be generated to the alarm monitoring client workstation.
125. All cardholder information shall be stored for future retrieval or reporting.
126. An access level form shall show System Operators all access levels configured in the SMS and the associated access levels that are assigned to the cardholder's current badge. The SMS shall allow the System Operator to double-click the mouse on any access level to view all of the card reader and timezone combinations that are assigned to that access level.
127. The SMS shall also support access groups, which shall be assigned to cardholders. Access groups will consist of up to thirty two access levels of which shall be viewed by System Operators by clicking on the desired access group.
128. Bulk Assignment or Modification or Deletion of Access Levels: System Administrators or System Operators shall have the option for Bulk Assignment, Modification, and/or Deletion of Access Levels to active badges for a group of cardholders. This feature shall allow System Operators to perform a search of the cardholder database and then apply any additions, modifications, or deletions of access level assignments to all active badges for that group of cardholders.
129. Search Records: The SMS must allow the System Operator to search for records and images using search criteria on any field(s) in the database. The System Operator must be able to enter the search criteria for one or a combination of fields. In addition, partial searches shall be performed. For example, a partial last name search on "Fitz" might return "Fitzpatrick," "Fitzgerald," or "Fitzerbauch." Using a partial name or letter shall return every record in the database that contains that information in its last name field. The SMS shall support basic Boolean logic searches (greater than, greater than or equal to, less than, less than or equal to, equal to). For example, a last name Boolean Search ">B<F" will return to the System Operator all records whose last name begins with the letter C, D, and E. These records shall be viewable sequentially using search keys.
130. The SMS shall allow for the System Administrator the ability to limit the ability of a System Operator to search the database. Thus limiting System Operators, who are using Alarm Monitoring, from searching through records when pulling up the cardholder screen from an event.
131. In a query with no matching records, the SMS must display a message within three (3) seconds indicating that there is no match for the key field information supplied.
132. Bulk Deletion of Cardholder Records: System Administrators shall have the option to perform Bulk Deletion functions for a group of cardholders. This feature shall allow System Administrators to perform a search against the cardholder database and then delete that group of cardholders.
133. Credentials: Support the following credential types and allow for direct Thermal Dye Sublimation printing onto the credential surface.

a. Composite Credentials - 3.375 in. x 2.125 in., UPVC Composite credentials with an ISO standard 30 mil thickness.
b. Proximity credentials: Proximity shall be an access control or identification technology that utilizes radio frequency (RF) circuits in microchip form. The microchips are encoded and transmit the encoded information when activated. The proximity card shall be used with its associated proximity card readers. The SMS shall be provided with the following proximity card design options:
    1) The proximity card shall be a polycarbonate-based card that cannot be run through direct card printers. This card shall offer a clip slot pre-punched.
    2) The proximity card shall be a PVC dual technology card that employs both proximity and magnetic stripe technology. It shall comply with ISO standard for thickness (30 mil). This card shall allow the printing of cardholder record fields including photo directly on the card.
c. Smart Cards P Contact and Contactless:
    1) Contact smart cards shall be utilized for access control or identity verification technology. Through use of an embedded memory chip, protected electronic data shall be stored on the smart card. Standard card configuration shall include cardholder, biometric, and access information. Contact cards shall require insertion into a card reader which interrogates the card via physical contacts. When coupled with a smart card reader, the smart card shall have the processing power to serve as an access control device, for use in network security and physical access control. The SMS must posses the ability to integrate with the ActivIdentity Card Management System. This integration must allow the System Operator the ability to personalize contact smart cards during the badge issuance process. The integration also must allow for communication during such events as badge encoding, activation, deactivation, and deletion.
    2) Support MIFARE® contactless smart card technology. Contactless smart cards shall be utilized for access control and/or identity verification. MIFARE cards, developed by Philips Semiconductors, shall be presented to a card reader for a transaction to take place using wireless transmissions. They shall be passive devices, requiring no built-in power source. Power shall be supplied from energy generated in the coil of the card being places within the radio-wave field of the card reader.
    3) With MIFARE cards, security shall be handled with challenge and response authentication techniques, data ciphering, and message authentication checks. Uniqueness of cards shall be guaranteed through serial numbers that cannot be altered.
    4) Support shall be provided for encoding MIFARE badges with a custom encryption key. This capability will operate in conjunction with readers configured with a matching key, such that these customized credentials will not be recognized by standard MIFARE readers, and standard MIFARE credentials will not be recognized by these customized readers.
    5) The SMS shall support GemEasyLink680 and GemEasyAccess332 or GemProx P2 encoders. Using the GemEasyLink680 and GemEasyAccess332 or GemProx P2 encoders the SMS shall be able to support both 1kByte (8kBit) and 4kByte (32kBit) MIFARE smart cards.

6) The SMS shall support the input of a MIFARE serial number during standalone and inline printing. The SMS shall be able to read the serial number of the MIFARE card during the print process and have it automatically populate the badge ID field.
7) The SMS shall support the creation of genuine, licensed HID format MIFARE badges compatible with standard HID MIFARE readers, without the need to order customized readers from HID.
8) Support shall be provided for the encoding of genuine licensed HID Corporate 1000 format, including full HID Corporate 1000 parity structure, to the HID MIFARE formatted credential.
9) The SMS shall support the creation of vendor-independent Open Encoding Standard (OES) MIFARE badges from completely unprogrammed MIFARE cards. The system shall allow OES badges to be secured with a user-defined MIFARE authentication key for reading, and a different user-defined MIFARE authentication key for writing and modification. The encoding shall be compatible with OEScompliant readers from any manufacturer. In addition to the creation of OES badges, the SMS shall be capable of creating OES re-keying cards that will allow the authentication key of OES compliant MIFARE readers to be reprogrammed without vendor assistance.
10) Support DESfire® contact-less smart card technology. Contactless smart cards shall be utilized for access control and/or identity verification. DESFire cards shall be presented to a card reader for a transaction to take place using wireless transmissions. They shall be passive devices, requiring no built-in power source. Power shall be supplied from energy generated in the coil of the card being places within the radio-wave field of the card reader. With DESFire cards, security shall be handled with challenge and response authentication techniques, data ciphering, and message authentication checks. Uniqueness of cards shall be guaranteed through serial numbers that cannot be altered. The SMS shall support Integrated Engineering SmartID Pro and Phillips Pegoda encoders. Using the encoders the SMS shall be able to support 16k DESFire smart cards.
11) Support HID iCLASS® contactless smart card technology. Contactless smart cards shall be utilized for access control and/or identity verification. iCLASS cards, developed by HID, shall be presented to a card reader for a transaction to take place using wireless transmissions. They shall be passive devices, requiring no-in power source. Power shall be supplied from energy generated in the coil of the card being places within the radio-wave field of the card reader.
12) With iCLASS cards, security shall be handled with challenge and response authentication techniques, data ciphering, and message authentication checks. Uniqueness of cards shall be guaranteed through serial numbers that cannot be altered.
13) Support shall be provided for encoding iCLASS badges with a custom encryption key. This capability will operate in conjunction with readers that have been ordered with a matching key, such that these customized credentials will not be recognized by standard iCLASS readers, and standard iCLASS credentials will not be recognized by these customized readers.
14) Support shall be provided for the encoding of genuine licensed HID Corporate 1000 format, including full HID Corporate 1000 parity structure, to the iCLASS credential.

15) The SMS shall support HID OEM-100 and OEM-150 encoders. Using the HID OEM-100 and OEM 150 encoders the SMS shall be able to support 2k and 16k iCLASS smart cards.
16) US Government Smart Cards: The SMS shall support reading the access control data (FASC-N) from US Government issued Contactless smart cards, including PIV end point dual interface cards, as well as compatible cards such as CAC dual interface cards, so long as the cards conform to the requirements outlined in FIPS-201 and HSPD-12.
17) Support shall be provided for reading the 200 bit BCD FASC-N output of FASC-N readers, and concatenating the Agency Code, System Code, and Credential Code into a full, globally unique 14 character credential number. The concatenated credential number must be the human-readable equivalent of the three fields in a string. Alternative representations are not acceptable.
18) Support shall be provided for reading the 75 bit Wiegand Binary output of GSA approved FASC-N readers, and concatenating the Agency Code, System Code, and Credential Code fields into a full, globally unique 14 character credential number. The concatenated credential number must be the human-readable equivalent of the three fields in a string. Alternative representations are not acceptable.
19) The SMS shall support mapping and importing of the full FASC-N data contained on TWIC (Transportation Worker Identification Credential) and PIV cards. The "Full FASC-N (Hexadecimal)" shall be provided as a field in the FASC-N drop-down in the SMS forms designer tool to map to the full FASC-N data contained on TWIC and PIV cards. TWIC card values shall be mapped to the corresponding cardholder user-defined fields in order to make import possible. A TWIC or PIV import source shall be supported to import the data. If using a TWIC import source, the PIV data shall be imported along with the TWIC Privacy Key and the full FASC-N data. However, if using a PIV import source, only the PIV data shall be imported. A PIN shall be required to import the following PIV data fields: Fingerprints, Facial image, and Printed information. Without a PIN, only these PIV data fields shall be imported: FASC-N, GUID, and Card Expiration Date. The TWIC data shall not require a PIN. It shall be imported into the database for hardware integration use and shall be not visible to the user.

134. Enrollment and Credential Creation - Enrollment:
    a. System Operators shall be able to enroll cardholders on a one by one basis. System Operators will fill in all required fields including name and badge type. The SMS shall Determine a number of attributes based on the cardholder's badge type. These attributes shall be:
        1) Default Deactivation Date or Time - The deactivation date or time shall have the ability be set for a pre-determined number of days, months, or years; or for an exact specified date.
        2) Default Access Levels
        3) Badge Design Layout
        4) Which Printer will Produce the Badge
        5) Information and Encoding Format to be Encoded onto the Magnetic Stripe
135. Based on the badge type selected, additional fields shall be required for data entry above and beyond the standard required fields. For example, a Contractor badge may require the field "Company Representing" to be filled in before the badge can be saved and printed.

a. System Operators shall also enter a Badge ID of up to 18 digits for the cardholder. The cardholder Badge ID shall be determined in one of the following manners:
   1) Manually entered by the System Operator
   2) Automatically generated by the SMS
   3) Use of the Social Security Number as the Badge ID number
   4) Use of EMPID as the Badge ID number

136. Badge ID ranges shall be able to be pre-defined, if desired, by the System Administrator based on Badge Type. For example, the Employee Badge Type may allow Badge IDs to range from 1-49,999 while the Visitor Badge Type Badge IDs range from 50,000-50,999. Multiple Badge ID ranges may be configured for each Badge Type. System Administrators shall have the option of determining how Badge IDs are generated for each Badge Type. For example, the Employee Badge Type shall generate Badge IDs automatically while Visitor Badge IDs must be manually entered into the system at the time of enrollment. Badge ID ranges may be system wide. For example, all Badge IDs(regardless of Badge Type) must fall within a specific range.
137. System Operators shall have the option of utilizing PIN Codes of up to nine digits, embossed numbers, and anti-passback exemptions for each cardholder who is enrolled in the SMS. System Operators shall also assign any temporary access levels for each cardholder that is enrolled.
138. The SMS shall allow for fast and efficient re-assignment of Badge IDs for use for Temporary badges through use of Re-Assignment Wizards. Re-assignment shall be such that the Badge ID shall be stored in the Audit Trail and reported with the cardholder that was assigned to that Badge ID for the specified period of time.
139. Cardholder Image Capture:
   a. Compatible with flash lighting, RGB video cameras, composite input cameras, S-Video input sources, USB sources and digital cameras and allow the capturing of the cardholder image at a minimum resolution of 1024 x 968.
   b. SMS image capture, storage, and hardware compression techniques must be in compliance with the ANSI standard or JPEG (Joint Photographic Experts Group). Cardholder images must be stored as Binary Large Objects (BLOB) within the cardholder record.
   c. Provide the ability to capture a cardholder's image through the use of any industry standard scanner or digital camera that utilizes a TWAIN interface. Images shall be able to be scanned in at up to 16.7 million colors for a true color scanned image. When using a digital camera that supports multiple resolutions, the system shall allow the operator to select the desired resolution.
140. Image Import: Allow for System Operators to have the ability to import a cardholder's image at the time of enrollment. The SMS must support the following image formats:
   a. Bitmaps (.bmp, .dib);
   b. JPEG (.jpg);
   c. JFIF (.jif);
   d. Zsoft PCX or DCX (.pcx, .dcx);
   e. Adobe Photoshop (.psd);
   f. CALS Raster (.cal);
   g. GEM or Ventura IMG (.img);
   h. IBM IOCA (.ica);

i. WordPerfect Raster (.wpg);
j. Macintosh PICT (.pct);
k. Portable Network Graphics (.png);
l. TIFF (.tif);
m. Windows Metafile (.wmf, .emf);
n. Targa (.tga);
o. Kodak Photo CD (.pcd);
p. Kodak Flashpix (.fpx);
q. Encapsulated Post Script (.eps).

141. Auto-crop the Enrollment Photograph: The SMS shall allow the image being captured or imported to be automatically cropped based on the location of the eyes in the captured or imported image. The SMS shall also allow the operator to override the auto-crop with a manual crop window.
142. Crop Window Attributes: The SMS shall allow for the image capture crop window to be both movable and sizable. System Administrators shall have the option to give System Operators the ability to size and/or move the crop window. System Administrators shall have the ability to have the SMS maintain the aspect ratio of the image if the captured image is smaller or larger than the pre-defined image object on the badge.
143. Business Card Scanner Enrollment: The SMS shall support an integrated business card scanner for automatic population of specific visitor information fields. The VMS shall support the Corex CardScan business card scanner.
144. Digital Certificate Management: The SMS shall support Digital Certificate Services to enable System Operators to securely obtain digital certificates for smart card cardholders. The SMS shall allow a System Operator to enroll and issue the smart card to each cardholder during enrollment process. This shall allow the issuing of a Smart Card Logon certificate (which provides authentication) or a Smart Card User certificate (which provides authentication plus the capability to secure e-mail) for the purpose of Smart Card Login to PCs. The Digital Certificate shall allow cardholders to log on to a computer with a smart card, instead of needing to type CTRL+ALT+DEL. The SMS shall be able to link a SMS cardholder account to the cardholder's Active Directory network account.
    a. Smart card readers: The SMS shall support any smart card reader(s) that have been tested by the Microsoft Windows Hardware Quality Lab and have obtained the Windows- compatible logo be installed on Windows 2003 or XP computers.
    b. Supported smart cards: The SMS shall support the Gemplus GemSAFE and Schlumberger Cryptoflex smart cards included in the default Windows 2003 installation.
    c. System Configuration or Network Account Allocation: The SMS shall enforce the allowable number of Network accounts per Cardholder
    d. Linking Network Account to Cardholder Accounts: System Administrators shall be able to link an existing Windows Active Directory Account to an SMS cardholder account. Conversely, System Administrators shall be able to unlink an existing Windows Active Directory Account to an SMS cardholder account.
    e. Manage Certificates: Through services such as DataConduIT, IT Administrators shall provide facilities to notify IT of events in the SMS that would potentially lead to certificates being revoked or suspended. Thus, SMS Certificate Services provide facilities to manually perform following actions on issued certificates:

1) View certificates. The System Administrator shall be able to view certificates issued to a particular cardholder by SMS.
2) Revoke Certificates.
3) Renew Certificates.
4) View Certificate Audit Trail. Each Certificate Authority shall maintain an audit trail of certificate requests and the certificates that are issued until they expire. The audit trail shall record all certificate transactions including failed requests and all of the information contained in each issued certificate. It also shall provide the information that is required to revoke a certificate and add it to the revocation list. System Administrators shall query the audit trail to locate and view information about any certificate request or any certificate that has been issued by the SMS.

145. Card Management System Support
    a. The SMS shall support any smart card reader that has been tested by the Microsoft Windows Hardware Quality Lab and has obtained the Windows-compatible logo to be installed on Windows 2003 or XP Computers.
    b. The SMS shall support ActivIdentity Server, and ActivIdentity Client.
    c. The SMS shall support issuing of a credential with the self-issuance and local issuance model. For self-issuance the credential will be issued a temporary pass code that will allow the cardholder to login to the ActivIdentity Self Service Portal to complete the issuance process. For local issuance the credential will be given a permanent pin number to secure the credential. The credential will also be completely personalized with all certificates and applications, based on the configuration of the CMS system.
    d. The SMS shall support verifying the cardholders fingerprint while the card is being issued. This option shall by configurable as a system wide setting.
    e. The SMS shall read the card serial number during issuance, either inline during the printing process or on a stand-alone PCSC compliant reader or encoder that is connected to the workstation
    f. The SMS shall support the issuance of a card that either has a pending request from a third-party IDMS (Identity Management Server) or create a new request. The issuance of a card based on a previous request, shall be configured as a system wide setting.
    g. The SMS shall support the issuance of a new card and a permanent replacement card. During the issuance of a permanent replacement card the certificates will be transferred to the new card, based on the configuration of the CMS system.
146. Badge Design: Support the ability to create and maintain badge designs. Features shall include the ability to support:
    a. Complete Badge design and Layout tools
    b. Chromakey
    c. Image Import
    d. Ghosting
    e. Signature Capture
    f. Bar code
    g. Smart chip support
147. ID Printers: The SMS shall support double-sided full color printing on those printers in which double-sided full color printing is available. The SMS shall also support edge to edge printing on those printers in which edge to edge printing is available. The SMS shall support high-speed printing on those printers in which high speed printing is available. The

SMS shall also support holographic overlays on those printers in which holographic overlay support is available.

148. Print Limits: The SMS shall allow System Administrators to limit the number of times A cardholder's credential can be printed.
149. Batch Printing: The System Operator must be able to print a credential immediately or continue enrolling cardholders with the intention of batch printing at a later time. The SMS Badging client workstation shall have the ability to print a large volume of badges with a single command using a search command. The System Operator must have the option of printing all badges, printing selected badges, or pre-viewing badges without printing.
150. The SMS shall have a 'log errors' feature for batch printing. This means that the SMS shall skip any Badges that cannot print due to missing information. For example, in a 200 card batch print job, there may be three cards that require information that is not available because the System Operator failed to enter the information. When printing, the SMS shall skip those three cards and print the other 197. A report can later be run to determine what information is missing for the remaining 3 cards.
151. In-line Magnetic Stripe Encoding: Utilizing an in-line magnetic stripe encoding device within the printer, the SMS must allow for magnetic stripe encoding of all its permanent credentials. This magnetic stripe shall conform to ABA Track II and ANSI specifications. The SMS shall allow System Administrators to define attributes for card number, facility code and issue code, as well as starting card number.
152. The SMS shall support a multi-track custom encoding feature. System Administrators shall be able to encode user-defined custom expressions on any of the three (3) tracks of the magnetic stripe of a credential.
153. The following information shall be able to be encoded on any of the three tracks of the magnetic stripe:
    a. Access Control Information
        1) Facility Code
        2) Card Number
        3) Issue Code
    b. ASCII Text
    c. Database Fields
    d. ISO or IEC 7812-1 Check Digit
154. The SMS shall support encoding data onto a JIS II magnetic stripe using JIS II-capable Fargo printers, including the Persona C30, Persona M30, DTC400, DTC550, HDP600, and HDP5000.
155. Image Export: Have the ability to export a captured and cropped cardholder image to an industry standard JPEG (.jpg) file format.
156. Real Time User-definable Image Compression: The SMS must support a real time user-definable image compression utility. The image compression utility shall give System Operators the ability to compare image quality versus compressed image size ratios. This process shall be done in real time and must not require System Operators or System Administrators to go to a program or .ini file outside the program to adjust the ratio. The SMS shall give System Administrators the ability to set SMS default compression settings and give System Operators, with proper permissions, the ability to override those settings. The better the image quality, the larger the image size (affecting hard drive space and speed

of records traveling across the network). 157. Bar code Support: Support the following bar codes: a. Code 3 of 9 (3:1)

b. Code 93
c. UPCA
d. EAN 13
e. EAN 8
f. Code 128 A
g. Code 128 B
h. Code 128 C
i. Codabar
j. PostNet (Zip +4 Postal)
k. Code 3 of 9 (2:1)
l. Interleaved 2 of 5 (2:1)
m. PDF-417 (2D)
n. Code 128 Auto
o. UCC-128
p. MSI Plessey
q. Extended Code 3 of 9
r. Extended Code 93

158. System Management Console: The SMS shall provide a utility that provides system information and access to log files that can be used to aid in troubleshooting SMS issues.
159. System User Feedback Tool: The SMS shall provide a tool to allow the SMS USER the ability to provide feedback from a menu item available in multiple SMS applications. The tool shall launch a Web feedback form that allows the SMS USER to send feedback about the SMS to the MANUFACTURER.
160. Device Discovery Utility
161. The SMS shall provide a Device Discovery Utility (UTILITY). The UTILITY shall allow the ability to discover IP cameras, device servers, access controllers, and wireless access points. The UTILITY shall discover devices in the local subnet as well as across the multiple subnets configured on the network.
162. The UTILITY shall allow searching and discovering IP cameras on a network, specifically for the purpose of identifying the IP cameras' IP addresses. The UTILITY shall be able to search and discover cameras produced by at least six (6) different camera manufacturers.
163. The UTILITY shall allow the ability to discover Lantronix® device servers, LNL-2210, LNL-2220, and LNL-3300 access controllers, and Lenel ILS wireless access points.
164. The UTILITY shall support the ability to turn on or off discovery based on device types and manufacturer. The UTILITY shall support displaying the devices grouped by Brand, Discovery Service, Device Status, and Device Type. The UTILITY shall support displaying the devices sorted by Brand, Model, Version, Command Status, IP Address and Port, Hardware Address, Discovery Service, and Device Type.
165. The UTILITY shall support performing functions (depending on the type of device selected) such as Ping Device, Reboot Device, Check for Default Password, Get Version, Launch Device Web Site, Save Credentials, and Change IP Address.
166. Hardware Devices Notes Field
167. The SMS shall allow users to enter text as notes for the following types of devices:

access panels, readers, video recorders, cameras, fire, intercom, personal safety, receivers, intrusion detection, PLC, POS, and SNMP. These notes shall be available from the SMS's Alarm Monitoring application. The Notes field shall be able to hold a maximum of 1999 characters. The Notes field shall not allow more text to be entered than can be saved. The Notes field shall support Unicode characters for SMS Language Packs.

168. System Administration
    a. System Configuration
169. The SMS shall provide system icons and/or menu selections for each function requiring configuration of SMS options or peripherals (client workstations, field hardware, network functions, communications, reports, etc.). Icon tools bars shall be sizable, movable, and removable. Each form must be in a tab format and shall provide point and click mouse functionality HF<A: R<6BAFS BE 7EBC-down menus to insure configuration is simple. As soon as a function is defined, it shall appear in any other configuration form list that requires that function. The SMS shall support sorting capabilities for multi-column lists. To sort on a multi-column list, the System Operator shall only have to click on the column that is to be sorted.
170. These forms shall be available only to the System Administrator to make system additions or changes to existing configurations. All SMS configuration options and forms shall be documented in the System Administrator's Manual to assist in the selection of options. a. Pre-defined Database
171. System Administrators shall have the option to install a pre-defined database onto their system complete with sample records and configurations. This sample database shall have a configuration that matches that of the VAR demo cases so that VARs can test and troubleshoot the SMS if necessary.
    a. System Configuration Setup Wizards
172. The SMS shall support SMS configuration setup wizards to guide System Administrators through the configuration of the access control module of the system. The setup wizards shall guide System Administrators step by step by asking a series of questions that, when answered, will allow the SMS to automatically configure itself. The setup wizards shall allow for multiple devices to be added in a single command to allow for easy and efficient SMS software setup. There shall be at minimum, setup wizards for Intelligent System Controllers and Card Readers. a. Single Sign-on Support
173. The SMS shall provide support for single sign on capability. Single sign-on shall allow System Administrators or System Operators to authenticate into SMS applications using their Windows domain account.
174. Sign sign-on shall support the following scenarios:
    a. Allow System Administrators or System Operators to interactively run SMS applications without having to enter a username or password. This shall make administration of the SMS easier since maintenance of separate SMS usernames and passwords is not required.
    b. Allow SMS API scripts to authenticate. These scripts shall be run using a Windows account allowing a seamless and secure way to authenticate the account and restricting the script to those actions that the user is permitted to perform.
    c. Password Privileges
        1) The SMS shall allow the System Administrator to configure each client workstation with those applications that may be run on that client workstation. Individual System Operator passwords will further restrict System Operator functions and shall

be specific to each System Operator. Specific System Operator restrictions shall include:

a) Access to screens or functions (for example: alarm monitoring, badge issue)

2) Specific tasks allowed (for example: modify data, view only)
3) Alarm Monitoring functions (for example: clear alarms, output control, traces, reports)

175. If a System Operator is denied access to specific functions, those functions shall not appear (or shall be ghosted) on the System Operator's client workstation or menu bar while that password is logged in. Passwords shall not print in any report.
176. System Administrators and Operators shall have the ability to change their password at any time in the SMS by logging into the SMS with their current password and then changing it through menu options. a. Strong Passwords
177. The SMS shall support the use of strong passwords. a. System Operators
178. The SMS shall support an unlimited number of System Operators at any time. Each System Operator shall be assigned a logon ID and password. Each System Operator shall be assigned permission levels for system administration and configuration functions, Credential Management functions, alarm monitoring functions, digital video management functions, asset management functions, visitor management functions, remote access level management functions, and database field viewing options.
179. The SMS shall be able to provide information on the date and time a new System Operator was created. The SMS shall also be able to provide information on the date and time the System Operator information was last modified. There shall also be a notes field when entering a new System Operator where information in regards to the System Operator can be stored.
    a. System Permissions
180. Every major feature, function, and cardholder page in the SMS shall be permission protected. Each System Operator shall be assigned permission or no permission to use or view or access each feature and function in the SMS. Permission groups shall be broken into three categories: System Administration, Credential Management, and Alarm Monitoring.
181. Every page in the Cardholder Form shall be permission protected. Each System Operator shall be assigned view permissions for each page of information in the Cardholder Form. 182. Every database field in the SMS shall be permission protected. Each System Operator shall be assigned view or edit permissions for each personnel database field in the SMS. 183. Ad-hoc Database Report Generator

184. The SMS must provide an ad-hoc customized report generator package integrated with the SMS's database. This program shall allow the System Administrator to create reports using the relational database structure. Among other reports, a tabular type report shall be configurable which will detail any information from the database in a columnar format with headings, breaks, sub-totals and totals. The report must also be able to be created to produce a flat ASCII export file. Access rights shall be provided to allow the System Administrator the privilege of creating, deleting, updating, saving, processing, viewing and printing reports. The reports are to be printed on a dot matrix printer or on a laser printer. Report configuration shall use menu options and drop-down list boxes to define that database fields are to be used, linked, or joined. They

shall also be used to specify conditions and column order, as well as describe the layout and headings. 185. Custom Report Writer

186. The SMS shall support an industry standard, off the shelf, custom report writer, such as Crystal Reports 11, or 11.5. The custom report writer shall support multiple report types including, but not limited to, multiple section reports, form style reports, conditional reports, query reports, and columnar reports. The custom report writer shall have BLOB Bitmap support and shall come standard with a formula editor with more than 160 built in functions for System Operators to manipulate data. It shall have export capabilities to ASCII files, Microsoft Mail, or ODBC file formats. The custom report writer shall be compatible with industry standard SQL databases, such as Microsoft SQL Server 2005 or Microsoft SQL Server 2008.
187. System Tape Backup
188. A mandatory requirement, the SMS shall provide tape backup and restore programs utilizing the multi-tasking capabilities of the SMS and operating system. These programs shall run concurrently with any other application. Database backup must occur dynamically while other alarm monitoring, badging, access control applications remain active.
189. The tape backup feature shall allow for three levels of tape backup; 1) Incremental, which will back up to tape all changes to data and images that have changed since the last incremental tape backup, 2) System, which will back up the operating system and application files only, and 3) Full, which back ups all files.
190. A database snapshot shall occur prior to a tape backup and the actual backup shall be performed in the background, utilizing the benefits of the multi-tasking operating system, without interfering with the ability of System Operators to exercise other functions.
191. Client workstations
192. System Administrators shall have the ability to configure each client workstation on the SMS to utilize any combination of event printers, CCTV controllers, and video capture boards. For each printer or CCTV controller, System Administrators shall be able to select the port that the device is connected to on the client workstation and the communications speed.
193. PIN Numbers
194. The SMS shall have the ability to support up to nine (9) digit PIN Numbers for each cardholder in the SMS. PIN Numbers shall be created either manually through System Operator entry or generated randomly by the SMS. The SMS shall have the ability to be configured to allow for unique PINs for each cardholder and the ability to modify cardholder's PIN numbers at a later date.
195. List Builder
196. System Administrators shall have the ability to pre-define information that will appear in each of the pre-defined drop-down lists. There shall be no limit to the number of items that shall be a part of a list. Lists can have items added to them or deleted from them at any time.
197. Archiving
198. The SMS shall allow System Administrators to archive offline history files to magnetic media. Offline files shall include access events and System Operator transactions that have been purged from the reportable database. The offline files MUST be in a "ready to import" format for easy insertion of information back into the online database. Different event types may remain in the database for different time periods according to the System Operator's specification.

199. Any record older than the specified dates shall be purged to the offline history file for archiving. Reports shall be generated from the archived files if necessary. Archiving shall be a scheduled, automatic function.
200. Remote Dial-In Capabilities
201. The SMS shall support remote dial-in capabilities for SMS troubleshooting, SMS configuration, and alarm monitoring capabilities.
202. VAR and/or System Administrators shall be able to dial in to the CUSTOMER Database server to troubleshoot the CUSTOMER's system. This will allow System Administrators to locate any problem areas and, many times, fix the error over the telephone from a remote location.
203. Remote dial-in shall also be used for SMS configuration and/or alarm monitoring from remote locations using a client workstation. The client workstation shall have the ability to operate on a Laptop PC that meets the client workstation minimum specifications.
204. Reader Groups

a. The SMS shall support reader groups. The SMS's Grouping form shall be used to: 1) Specify the group or groups to which the reader belongs.
    2) Search for readers by group (The search for readers button is available from all of the forms in the Readers folder.)
    3) Name and save lock group search criteria for future use.
b. Six (6) default reader group drop-downs are provided on the SMS's Grouping form.

205. The SMS shall support a multi-PC, multiple database synchronization architecture (herein after Mobile Enterprise Architecture) using a database server. The database server shall allow multiple wearable or mobile computers to be connected to it (via wired or wireless LAN or WAN architecture). In a stand-alone environment, connections shall occur only during synchronization.
206. The database server shall contain a master copy of all relevant system data. An unlimited number of mobile enterprise client workstations may be connected to the database server.
207. In a stand-alone environment the mobile enterprise computing PC shall contain a copy of all required core information obtained from the database server. This shall include, but not be limited to, cardholders, badges, badge types, and access permissions.
208. Screen Designer Tool

a. SMS Cardholder Standard Fields and Objects

209. The SMS shall support at a minimum the following standard fields for personnel information: 1) Last Name
2) First Name
3) Middle Initial
4) Social Security Number
5) Badge Type
6) Address 1
7) Address 2
8) City
9) State
10) Zip Code
11) Phone Number
12) Birth Date

13) Title
14) Department
15) Division
16) Location
17) Building
18) Floor
19) Office Phone Number
20) Extension
21) Signature
22) Last Reader Accessed
23) Record Last Changed
24) Badge ID
25) Issue Code
26) Number of Prints
27) Activation Date
28) Deactivation Date or Time
29) Badge Status
30) PIN Number
31) Embossed Number
32) Date of Last Badge Print
33) Photo

34) Photo Display

b. SMS Asset Standard Fields and Objects

210. SMS shall support at a minimum the following standard fields for asset information:

1) Scan ID
2) Asset Name
3) Acquired
4) Replace
5) Type
6) Subtype
7) Serial Number
8) Department
9) Assessed Value
10) Replacement Value
11) Last Inspection
12) Next Inspection
13) Record Last Changed
14) Photo
15) Photo Display
16) Last Reader Accessed
17) Assignment Button

b. User-definable Fields

211. Should the SMS standard fields not be suitable, System Administrators shall have the ability to modify any standard field to customize the cardholder, asset, and visitor forms as desired. The SMS shall also allow System Administrators to add custom fields in addition

to or replacement of any standard fields on a minimum of thirty two (32) pages each of information for the cardholder, visitor, and visit forms and one page of information for asset. User-defined fields absolutely shall not be pre-defined, meaning only the labels can change while the properties cannot. System Administrators shall have a minimum of sixteen pages of which to design their screens with standard and custom fields.

a. System Administrators shall have the ability to modify the pages of information in any combination as follows:
   1) Move standard database fields to different locations on the cardholder forms
   2) Delete standard database fields that are not desired
   3) Keep standard database fields in the same location as the factory ships them, but changing the label and/or any field attributes. For example, Zip Code may be changed to Postal Code and the attributes changed from a number field to text field for Canadian Installations
   4) Add new fields to the cardholder forms each with their own unique set of attributes
   b. Field Types

212. The SMS shall support, at a minimum, the following field types:
1) Text Fields
2) Date Fields
3) Numeric Fields 4) Drop-down Lists a. Field Attributes

213. System Administrators shall be able to assign any combination of the following attributes to each field defined:
1) Positioning of the field on the form
2) From which page the field can be viewed
3) From which page the field can be edited
4) The font to be used for the information that will appear in the field. The SMS shall support all standard Windows fonts
5) The style to be used for information that will appear in the field. The SMS shall support bold, italic, both, and regular typeface styles
6) Any effects to be used for the information that will appear in the field. The SMS shall support strikeout and underline
7) Whether the field is required
8) Whether the field is to be indexed
9) Whether the field is unique
10) If a template is to appear in the field
11) If a default value will appear in the field b. Field Styles

214. System Administrators shall be able to assign any combination of the following styles to each field defined: 1) Multi-line field
2) Horizontal Scroll
3) Vertical Scroll
4) Auto Horizontal Scroll
5) Auto Vertical Scroll
6) Enter means next line of text
7) Number
8) Uppercase
9) Lowercase

10) Read Only
11) Align Right
12) Password
13) Sunken
14) Border
15) Inside Edge
16) Raised 17) OEM Covert

b. Field Alignment and Width Tools

215. The SMS shall support the following field alignment tools to allow System Administrators to align fields and set uniform widths to fine tune the look and feel of the screens. The SMS shall allow System Administrators to select multiple objects simultaneously and align them to their desired position and/or set a uniform width. The following field alignment tools shall be able to be used in any combination:

1) Align all objects selected to the far left edge of the farthest left selected object
2) Align all right edges of selected objects to the right edge of the farthest right selected object
3) Align the tops of all selected objects to the top edge of the highest selected object
4) Align the bottom edges of all selected objects to the bottom edge of the lowest selected object
5) Align all selected objects to be vertically centered with respect to each other 6) Center all selected objects
7) Make all selected objects the same width as the smallest object selected
8) Make all selected objects the same width as the widest object selected
9) Make all selected objects the same height as the shortest object selected
10) Make all selected objects the same height as the tallest object selected
11) Evenly space all objects vertically between the two most outer objects
12) Evenly space all objects horizontally between the two most outer objects
13) Bring object to the front of the page 14) Send object to the back of the page a. Tab Ordering

216. The SMS shall allow System Administrators to set the TAB order (the order in which the cursor moves throughout the fields) of the SMS when System Operators utilize the TAB key to move throughout the cardholder form.

217. Map Editor Module

218. The SMS shall support graphical map creation software that shall allow the import of map backgrounds from any standard 'off the shelf' drawing package in the formats listed below:

a. AutoCAD DXF (.dxf)
b. Bitmaps (.bmp, .dib)
c. JPEG (.jpg)
d. JIFF (.jif)
e. Zsoft PCX/DCX (.pcx, .dcx)
f. Adobe Photoshop (.psd)
g. CALS Raster (.cal)
h. GEM/Ventura IMG (.img)
i. IBM IOCA (.ica)
j. WordPerfect Raster (.wpg)

k. Macintosh PICT (.pct)
l. Portable Network Graphics (.png)
m. TIFF (.tif)
n. Windows Metafile (.wmf, .emf)
o. Targa (.tga)
p. Kodak Photo CD (.pcd)
q. Kodak Flashpix (.fpx)
r. Encapsulated Post Script (.eps)

219. These architectural type maps must allow the detailed layout of an entire structure, part of a structure, a floor or department within a building, or layout of the periphery of a facility. Once a map has been drawn, the System Administrator must have the ability to place system level icons of card readers, input and output points, video cameras, and other access control field hardware in the appropriate area to indicate their respective location on the map. This is to be accomplished by simply dragging the icon with the mouse to the appropriate location on the map.
220. The SMS must allow various maps to be associated with each area to provide for the creation of hierarchy of maps. Overview maps of an entire facility shall be able to be viewed as requested and nested maps shall be accessed from the overview map to enlarge a specific area or facility on the screen. Maps shall also support user-defined text that shall be placed onto the map background.
221. The SMS shall allow hardware device icons to be either static or part of a device group. Icons that are part of a device group shall allow the hardware device icon to change shape and/or color based on the current state of the device.
222. Maps shall have the ability to be printed and/or previewed from the Map Editing Module or the Alarm Monitoring application.
223. The SMS shall also support custom device icons to be used with the maps (.ico) files.
224. Import Module: The SMS shall support an import utility, which shall allow the CUSTOMER or VAR to import cardholder information into the SMS database. This shall allow the CUSTOMER or VAR to pre-populate the SMS database with existing cardholder data and/or add NEW records to an existing SMS database. The Import Module only supports SQL Server; it does not support Oracle. For Oracle, DataExchange must be used for data import.
225. The Import Utility shall be a 32-bit Windows application that shall be used to import standard ASCII delimited text files into the SMS. The import utility shall be utilized at the initial SMS setup and anytime a large number of records need to be imported into the SMS after the initial import. For example, a large university may import 10,000 records into the SMS during the initial SMS setup and then import 2,000 additional records each semester thereafter. The SMS shall check for duplicate records during the import, so that multiple copies of the same record are not added into the SMS database.
226. The import utility shall allow System Administrators to choose the delimiter for the ASCII file. This delimiter may be, but is not limited to, a comma, vertical bar, semi-colon, or asterisk. Fields in the SMS database, such as Address 2, that the CUSTOMER does not wish to use, may be left blank in the ASCII file.
227. The import utility shall be able to select the source drive where the ASCII delimited file is located as well as the destination drive where the SMS database is located.

228. The import utility shall also be able to import photos as part of the record into the SMS database. The SMS shall support the following file formats for the import of cardholder photos:

a. Bitmaps (.bmp, .dib)
b. JPEG (.jpg)
c. JIFF (.jif)
d. Zsoft PCX/DCX (.pcx, .dcx)
e. Adobe Photoshop (.psd)
f. CALS Raster (.cal)
g. GEM/Ventura IMG (.img)
h. IBM IOCA (.ica)
i. WordPerfect Raster (.wpg)
j. Macintosh PICT (.pct)
k. Portable Network Graphics (.png)
l. TIFF (.tif)
m. Windows Metafile (.wmf, .emf)
n. Targa (.tga)
o. Kodak Photo CD (.pcd)
p. Kodak Flashpix (.fpx)
q. Encapsulated Post Script (.eps)

229. The SMS shall include a progress meter to show the System Administrator the percentage of the import complete when importing large quantities of records.
230. SMS Server Redundancy

a. The SMS shall support multiple levels of fault tolerance and SMS redundancy listed and described below: 1) Hot Standby Servers
    2) Clustering
    3) Disk Mirroring
    4) RAID Level 10
    5) Distributed Intelligence b. Hot Standby Server Solution

231. The SMS shall support a fault tolerant server and redundant database architecture. It shall allow for normal operations to occur in the event that the Database Server fails. In the event of a server failure, the switch over to a backup server shall be automatic. System Operator intervention for switch over shall not be acceptable.
232. The SMS shall utilize two servers, which shall be configured identically. One server shall be designated as the Primary Server and the other shall be designated as the Backup Server. The Primary Server shall be the main server that is in use when the SMS is operating under normal conditions.
233. The SMS shall mirror the database information from the Primary Server to the Backup Server. This mirroring shall be conducted through standard local area network (LAN) communications. There shall absolutely not be any proprietary communication links between the Primary and Backup Servers.
234. All access control field hardware shall be configured for both the Primary Server and the Backup Server. Both the Primary and Backup Servers shall recognize the same TCP/IP ISC address on the network.
235. If the Backup Server is not running or receiving the mirrored files from the Primary Server, the Primary Server shall save the changes locally. Upon restored communications to the Backup Server, this information shall be automatically sent to the Backup Server.

236. In the event that the Primary Server fails, the Backup Server shall sense that the Primary Server has failed and is no longer on the network. The Backup Server shall check to see if the Primary Server is online every five seconds.
237. Upon sensing Primary Server failure, the Backup Server shall automatically initiate itself as the Primary Server and shall begin communication with the Intelligent Fields Panels. ABSOLUTELY NO SMS OPERATOR INTERVENTION SHALL BE REQUIRED. A message shall be broadcast to all client workstations on the network that the Primary Server has failed and the Backup Server has taken control. This process shall take no longer than two minutes to accomplish.
238. Once the Primary Server comes back online with the SMS, the Primary Server and Backup Server shall be able to be re-synchronized though automatic operation and resume normal operations. The synchronization process shall be fast, efficient, and take no more than five minutes.

a. Clustering

239. The SMS shall support a fault tolerant cluster server architecture. It shall allow for normal operations to occur in the event that the Database Server fails. In the event of a server failure, the switch over to a backup server shall be automatic. System Operator intervention for switch over shall not be acceptable.
240. The SMS shall utilize two servers, which shall be configured identically. One server shall be designated as the Primary Server and the other shall be designated as the Backup Server. The Primary Server shall be the main server that is in use when the SMS is operating under normal conditions.
241. The SMS shall use shared-media technology. This shall incorporate a third piece of hardware (for example: Dell PowerVault), which shall house the hard disk to be referenced by both servers. Since accessible media is dependent upon a third piece of hardware, emphasis shall only be placed upon the health status of the shared-media device. If the status of the shared-media device remains healthy, server up time is of no consequence to data integrity.
242. The shared-media device provides only a single point of failure. If this device fails, then data cannot be accessed. A dual point of failure shall be achieved by incorporating two shared-media devices that are mirrored (for example: two stacked mirrored Dell PowerVaults).
243. All access control field hardware shall be configured for both the Primary Server and the Backup Server. Both the Primary and Backup Servers shall recognize the same TCP/IP ISC address on the network.
244. In the event that the Primary Server fails, the Backup Server shall sense that the Primary Server has failed and is no longer on the network. The Backup Server shall check to see if the Primary Server is online every 5 seconds.
245. Upon sensing Primary Server failure, the Backup Server shall automatically initiate itself as the Primary Server and shall begin communication with the Intelligent Fields Panels. ABSOLUTELY NO SMS OPERATOR INTERVENTION SHALL BE REQUIRED. A message shall be broadcast to all client workstations on the network that the Primary Server has failed and the Backup Server has taken control. This process shall take no longer than 2 minutes to accomplish.
246. Once the Primary Server comes back online with the SMS, the Primary Server shall resume normal operations. a. Disk Mirroring

247. The SMS database server shall protect data against failure of a hard disk or hard disk controller by providing a disk mirroring configuration. The disk mirroring configuration shall allow data to be stored on dual hard disks running simultaneously. When any client workstation or Intelligent System Controller sends data to the database server, it shall be stored to both sets of hard disk drives. In the event any component on one channel fails, the other disk drive continues to operate without data loss or interruption. The SMS shall also send a warning message indicating that one disk drive has failed.

a. RAID Level 10

248. The SMS shall offer a Fault Tolerant Redundant Array of Independent Disks Level 10 (RAID Level 10) with a hot standby disk. RAID Level 10 shall provide redundancy of disk storage, controller channels and power supplies. Each array must contain a disk drive, high efficiency power supply, and cooling fan. This technology shall use multiple drives to store data with distributed parity, thereby ensuring data protection in an environment in which data is safe and easily restorable in the event of a hard disk failure. In the event a single drive within the array fails, a "Hot Standby Hard Disk" shall be available online and automatically switched with the failed unit.
249. The network administrator shall be able to replace the failed drive without taking the database server down, and it shall then become the hot standby. The array software shall rebuild the lost data from parity information stored on the other drives in the array. This entire procedure shall have no effect on the operation of the SMS and shall be automated.
    a. Distributed Intelligence
250. In the event SMS communications is lost or the database server fails, Intelligent System Controllers shall provide complete control, operation and supervision of all monitoring and control points. The ISC shall be configured with a UPS battery, which shall support the ISC for a 24 hour duration. The ISC shall be installed with enough memory to support up to 10,000 cardholders/100,000 events in a minimum configuration and be expandable to up to 250,000 cardholders/1,000,000,000 events.
251. The SMS shall incorporate performance tests and precautions so as to avoid SMS failure. In the event of a failure, transactions are to be stored in an ISC First In First Out (FIFO) buffer until the ISC comes back online, at which time all data is uploaded to the database server. The ISC shall register as online with the database server when communications are re-established. Should the ISC buffer fill and events are overwritten, an event will appear in the Main Alarm Monitoring Window notifying the System Operator that events were overwritten. The ISC shall send a time/date stamp of the last record or table update in its memory and request any new data changes or cardholder records which have changed since that time or date stamp. A complete download of database and access tables shall not be required because of offline operation.
252. Open Protocol Interface
    a. The SMS shall provide a set of standard Application Programming Interfaces (API's) and supporting documentation that allows hardware manufacturers and software application developers to interface their products into the SMS. The Application Programming Interfaces shall allow requests to occur from CUSTOMER to interface a third-party hardware or software solution based on SMS open architecture and SMS device independence.
    b. There shall be two components to the Application Programming Interfaces. There shall be a device interface and an application interface.
    c. The device interface shall allow extensibility to the number and types of hardware devices supported by the SMS. Each individual piece of hardware shall have its own

"driver" that shall understand how to communicate with the SMS hardware. These "drivers" or "device translators" shall translate a set of generic commands into specific device commands.

d. The device translators shall be implemented as COM (Component Object Model) objects so that they shall be loaded and unloaded as needed. Each device translator shall support certain interfaces that support a specific set of commands or methods. Some examples of typical interfaces could include an Access Control Interface for access control hardware, a Video Interface for DVR and NVR hardware, an Intercom Interface for intercom systems, an Intrusion Interface to support alarm inputs, etc. A particular device translator shall support many interfaces.
e. The main application that shall be used to control the various device translators is the SMS Communication Server (SCS). The SCS shall be the application that manages and sends the commands to the device translators. Other modules including Alarm Monitoring or System Administration shall communicate with the hardware devices by sending commands to the SMS Communication Server, which shall then send the commands on to the correct device or devices.
f. The device interface shall allow the software interface of any hardware device to be controlled and monitored via the SMS Alarm Monitoring application. This shall preserve customer investments in existing equipment as well as allow for system expansion to occur through the interface of the latest hardware technologies.
g. The application interface shall allow information to be exchanged between the SMS and other applications. The application interface shall provide the functions for interacting with the SMS. This includes the ability to extract information from the SMS database as well the ability to download, control and monitor information for all field hardware including access control panels, digital video systems, fire panels, alarm panels, intercom system, etc.
h. All functions of the application interface shall be defined in such a way that any Windows application or development environment with the ability to make "C" calls should be capable of making use of the API.

263. Open Supervised Reader Interface

a. The SMS shall provide connectivity to proximity and smartcard readers which provide continuous supervision and monitoring of reader processor and wiring integrity by means of a non-proprietary communications protocol standard. Supervision methods that simply supervise wiring or measure current draw are not acceptable, since they do not insure that the reader's microprocessor is actually operational. Likewise, proprietary protocols which are sole sourced or licensed for a fee are not acceptable, since they limit potential future expansion options for the SMS.

C. The preferred protocol is the Open Supervised Device Protocol (OSDP), since it is non-proprietary and meets the requirements stated above. Alternative supervised reader interface protocols will be considered only if they meet all of the technical requirements of this section AND can be shown to be non-proprietary.

END OF SECURITY MANAGEMENT SYSTEM

SECTION 28 20 00

CCTV SURVEILLANCE SYSTEM - IP

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of work is indicated by the requirements of this section. This specification describes the CCTV Surveillance System to be installed with the requirements and qualifications herein listed.

B. Furnish system complete.

C. Furnish all necessary components and hardware for a complete working system.

D. This specification is intended to provide the CCTV Equipment Contractors with the information and details to be used as the basis for the work described herein.

E. Systems shall be installed under Electrical Section with Electrical Contractor furnishing conduit and requirement power, wiring and pulling wire for CCTV Equipment Contractor, CCTV Equipment Contractor shall make all connections.

F. In many instances only major equipment items are specified and other components and hardware may be required to provide a complete working system.

1.2 SYSTEM DESCRIPTION:

A. This section describes the requirement for electronic surveillance. The system utilizes Closed Circuit Television Camera located as shown on the plans to survey designated areas. Video Signals are processed and displayed on monitors located in the control room and office.

1.3 APPLICABLE CODES AND STANDARDS:

A. U.L. Labels - Provide equipment which has been listed and labeled by Underwriter's Laboratories.

B. FCC Compliance - Comply with Federal Communications Commission Class "B" limits set forth in Subpart "J" of Part 15.

C. NEMA Compliance - Comply with National Electrical Manufacturers Association Standards as applicable.

D. NECA Standard - Comply with applicable portions of the National Electrical Contractors Association's Standard of Installation.

1.4 QUALITY ASSURANCE:

A. Equipment Supplier shall be authorized factory service representative for equipment supplied. Supplier shall maintain an office and service facility with factory trained personnel within fifty (50) miles of the site and provide service within twenty-four hours.

B. The Equipment Supplier's factory trained personnel shall directly supervise the entire installation, connections and tests. Supervision shall include on-the-job instructions for the installation and periodic testing. Final installation and connections for control consoles, equipment cabinets, cameras, etc., shall be made by the Equipment Supplier's trained personnel.

C. Before acceptance, manufacturer's representative will test and certify that the system is installed and functioning properly as intended by drawings and specifications. Test shall include operation of all devised and functions in entire system.

1.5 SHOP DRAWINGS AND CCTV CONTRACTOR WORK:

A. Unless otherwise indicated, provide items required for the complete CCTV Surveillance System as follows:
1. Install and connect all CCTV System equipment as indicated on the drawings.
2. Submit equipment/wiring floor plan layout, detailed terminal wiring diagrams, and equipment manufacturer data sheets prior to any installation of delivery of any equipment to the job site.
3. Provide approved copies of shop drawings which show correct device locations and quantities, correct conduit sizes, and cabling and conductor requirements to the other trades providing related work, supervise and work performed by these trades to assure a workable, completed system.
4. Upon completion of all work, a complete functional test of the entire system shall be performed, and if the system is fully operational, a final acceptance test shall then be scheduled with Owner's designated representative.
5. Provide personnel familiar with the installation and with full access to the system for the final acceptance test.
6. Correct punch list items resulting from the final acceptance test.
7. Provide a one (1) year test and inspection service contract as hereinafter defined.
8. Provide a one (1) year job site guarantee on all material and labor furnished.
9. Provide for any additional conduit of increase in conduit size which are required to make the proposed system functional, but which is not indicated on the design drawings.
10. Furnish all low voltage multi-conductor jacketed cables and low voltage central power conductors as required for a complete and workable system.

1.6 COMMON MANUFACTURER:

1. Equipment furnished in any one category shall be supplied from one manufacturer. For example, all cameras must come from the same manufacturer and all monitors, of the same size, shall be from one manufacturer.
2. Video equipment supplied with same model number shall be of the same series.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS:

A. All model numbers listed within this proposal are for equipment manufactured by Pelco. Equal products by Bosch will be acceptable.

2.2 IP VIDEO MANAGEMENT SYSTEM

A. The IP video management system shall consist of Digital Sentry® NVs version 7 software operating on an optimized Pelco-supplied hardware platform. The NVs software shall consist of

base software with individual, non-expiring licenses in the required quantity.

B. The IP video management system software updates shall be downloadable from a publicly available website.

C. The IP video management system shall support up to 128 combined IP and analog video streams, with up to 64 direct-attached analog cameras. Analog streams shall be supported using Pelco and/or third-party encoders.

D. The IP video management system shall provide 280 Mbps throughput for recording of analog and IP video streams, playback and export.

E. The IP video management system shall support recording of JPEG, MPEG-4 and H.264 IP streams.

F. The IP video management system shall support Pelco and third-party H.264 Megapixel video streams up to 10 Megapixel resolution with quantities based on a total system of 280 Mbps throughput for recording of analog and IP video streams, playback and export.

G. The IP video management system shall have a fully open architecture with support for both IP-specific camera as well as cameras with ONIVIF compliance.

H. The IP video management system shall support automatic detection of Pelco IP cameras. Third-party IP cameras shall be automatically detected dependent on IP driver versions and manufacturers specifications.

I. The IP video management system shall support up to 64 looping analog camera inputs with direct-attached 16-channel encoders; up to four direct-attached units. The direct-attached 16-channel encoders shall support H.264 compression, CIF, 2CIF, and D1 resolutions at maximum 30ips, 16 audio inputs and RS422/485 PTZ control with Pelco P and D protocols.

J. The IP video management system shall support an unlimited number of systems connected over a network. Each system shall contain two 1GB network ports; one for IP camera/encoder data, and one to connect to a network for client computer access.

K. The IP video management system shall be viewed, managed, and played back through a single user interface simultaneously with other Digital Sentry digital video management systems through supplied DS Admin or DS ControlPoint Client software.

L. The IP video management system shall operate on a 2nd Generation Intel® Core™ i7 processor and 8 GB of RAM.

M. The IP video management system shall utilize a Windows® 7 Ultimate 64-bit operating system.

N. The IP video management system shall support and have an option for an internal DVD+/-RW.

O. The IP video management system shall contain two DVI-D ports.

P. The IP video management system shall allow expansion of IP video channel capacity through a licensing without any hardware modification.

Q. The IP video management system shall support multiple models of IP cameras and encoders including Pelco cameras and encoders with Sarix technology and multiple third-party manufacturers.

R. The IP video management system shall support audio recording from Pelco cameras with Sarix technology in addition to third-party manufacturer's audio recording.

S. The IP video management system shall support recording the internal server with additional storage utilizing SCSI attached Pelco DX8100-HDDI storage.

T. The IP video management system shall be capable of continuous scheduled alarm/event and motion recording. Pre- and post- alarm recording shall also be available and shall be fully programmable on a per channel basis.

U. The IP video management system shall allow archival of video data to computers or SAN storage devices over a network connection with the optional DS Archive Utility. The archival schedule shall be either automatic at user-defined intervals or manual and shall be configurable per connected camera.

V. The IP video management system shall support network health and monitoring utilizing third-party SNMP monitoring tools.

W. The IP video management system shall indicate system performance and operation status utilizing a variety of HTML reports.

X. The IP video management system shall display system health monitoring data utilizing front panel LED displays and display popups.

Y. The IP video management system shall optionally support on-board video analytics in quantities of two or four channels with Active Alert software and the DS DataPoint interface. The DS DataPoint interface shall provide video analytics monitoring including tracking and counting objects and people.

Z. The IP video management system shall support Lightweight Directory Access Protocol (LDAP).

AA. IP Video Management Client Software requirements

1. The IP video management system shall provide the capability of running a client application in additional to the video management system.
2. A client computer with system compatible software shall be the user interface for viewing one or more systems. Live and recorded video and current event video shall be displayed on any client computer using a proper login and password. The client computer shall be able to connect to an unlimited number of recorders simultaneously to display live and recorded video.
3. Client Software shall be unlicensed and available to be installed on as many clients as required by the user.
4. Client Software shall be compatible with multiple DVR and NVR platforms to include all Pelco Digital Sentry®, Pelco DX8000/DX8100, and Pelco DX4100, DX4500/DX4600, DX4700/DX4800.

5. Client Software shall be password controlled such that password functionality set at each connected system will be recognized at the client. Password shall limit the ability to access live or recorded video as well as the ability to export video.
6. Client Software shall allow multiple monitor support for up to four displays per client workstation, providing virtual matrix functionality.
7. Client Software shall allow the connection of Pelco KBD5000 keyboard controllers to the client workstation to control PTZ operations and camera call-up.
8. Client Software shall allow video streams to be selectable from a system tree on an individual camera, individual system, client defined local groups, or from predefined recorder based groups.
9. Client Software shall be a tab based work environment with the ability to undock the tabs creating a virtual workspace on single or multiple monitor clients.
10. Client tabs shall include system management, live, and search options. Tabs can be displayed simultaneously on the client.
11. Systems Tab shall display and sort available systems, connection status, system names, system IP addresses, and custom categories. This tab shall additionally allow:
    a. Manual connect and disconnect of systems to the client
    b. Virtual systems naming
    c. Auto Connecting
    d. Adding, deleting, and editing available systems
    e. Live video tab shall have the ability to be created up to four times on a single client workstation providing for video display combinations and simultaneous video streams from as many different systems with consideration for maximum client bandwidth.
12. Live video tab shall provide the following functionalities:
    a. Quick Review which shall display recorded video from the last 1, 5, 15, 30, 60 or 90 minutes, providing near instantaneous review of recent events
    b. One week graphical display of recorded video
    c. Borderless display option
    d. Screen layout selection
    e. On the fly on-screen display changes including time, date, camera name, frame rate, frame size, alarm display, and border indicators
    f. Digital zoom
    g. User selectable in-video PTZ control or dashboard style control
    h. Drag and drop audio support associating any audio with any video
    i. Search video tab shall allow for the search of one or multiple cameras from one or multiple systems simultaneously. Search tab shall provide the following functionalities:
    j. Time and date search
    k. Advanced data search with DataPoint interfaced software to Active Alert Intelligent Video and POS
    l. Drag and drop audio support to associate audio with any video
13. Video export to any system accessible media including locally to HDD, CD/DVD, Flash USB device or to network storage
14. Video authentication of exported video via check sum verification
15. Alarm video tab shall allow for alarm pop-up and playback of active alarms. Alarms may be based on motion activity, an external software trigger from Active Alert analytics or a preset data alarm from DS DataPoint. An alarm list pane shall be displayed for playback of queued alarms.
16. The Client shall incorporate virtual matrix functionality whereby camera sequences may be created on the monitoring workstation with the following functionalities:

17. Each sequence shall have a maximum of 500 cameras
18. Each camera in the sequence shall have its own individual dwell time, from 1 to 60 seconds
19. Each entry in a sequence shall have the capacity to trigger PTZ camera presets, patterns, or auxiliaries
20. The Client shall have the capability to display recorded video with full VCR controls. This feature shall display video from multiple cameras simultaneously. The user shall be able to play video as fast as possible (all images), in real time, or by skipping a selectable number of seconds
21. The Client shall support simultaneous playback of up to sixteen cameras all synchronized with each other. Non-synchronous playback of multiple cameras shall not be acceptable
22. The Client shall support tours of multi-camera displays
23. Remote Client Minimum PC Requirements
    a. Processor: 2nd Generation Intel® Core i7 processor with integrated graphics
    b. Memory: 4 GB or higher
    c. Graphics Card: Graphics controller card with 512 MB (or greater) dedicated video memory
    d. Optical Drive: DVD
    e. Operating System: Windows 7 (32 or 64 bit)

BB. Network Server Video Recorder/CCTV Workstation
1. Shall be Pelco DSSRV-030-US
2. Supplied Accessories
    a. Power Cord
    b. USB Keyboard and Mouse
    c. Two (2) Bezel keys
    d. Rack Mount Kit (Brackets, rails, and hardware for rack mounting)
    e. DS-SRV-LIT (Documentation, resource and recovery disc)

CC. System Accessories
1. DS-SW-CAM: Includes eight IP licenses for Pelco and third-party IP cameras Additional DS-SW-CAM licenses can be purchased separately
2. ENC5416: Direct-attached analog encoder
3. DS-SRV-RAID: LSI 3Ware 9750-8i RAID controller card
4. DS-SRV-SCSI : Adaptec® SCSI Card 29320LPE
5. ENC5400-2PORT: 2-port host card (analog) connects 2 ENC5416
6. ENC5400-4PORT: 4-port host card (analog) connects 4 ENC5416
7. KBD5000 Keyboard: Desktop keyboard with control pods provides lens, iris and focus control; playback and menu navigation; and monitor control of one DS ControlPoint tear-off tab.

2.3 VIDEO ENCODERS

A. The video encoder shall be standards-compliant and provide a fully supported API that shall integrate with multiple video management systems.

B. The video encoder shall support 1, 2, or 4 camera inputs.

C. The 1- and 2- input video encoders shall support Power over Ethernet (PoE), 802.3af for the 1-input encoder and 802.3at for 2-input encoder. The 4-input encoder shall be powered by a

12VDC source.

D. The video encoder shall generate compressed H.264 video streams in standards-compliant baseline profile, main profile, or high profile. For 4CIF resolution, the encoder shall employ de-interlacing technology to support interlaced cameras while remaining compatible with standards-based decoders at baseline profile.

E. The video encoder shall provide for two independently configurable streams for each camera input. Each stream shall be capable of 4CIF resolution, 30 or 25 images per second (ips), NTSC or PAL. The settings of one stream shall not interfere or limit the settings for the second stream.

F. The video encoder shall be capable of generating 4CIF resolution, real-time video streams while also running intelligent video content analysis algorithms on each camera input. There shall be no need to degrade video resolution or frame rate to execute analytics algorithms.

G. The video encoder shall provide support for running any three Pelco video content analysis algorithms simultaneously on each channel. In addition, the encoder shall also be capable of processing video content analysis algorithms from Object Video.

H. The video encoder shall have provisions for a micro-SD card for each channel input. The video encoder shall be capable of recording JPEGs for alarm conditions on customer-supplied SD cards.

I. The video encoder shall support daisy chaining up to 4 encoders together to minimize the number of network ports utilized on a switch.

J. The video encoder shall provide for 1 line level audio input per video input. The 1- and 2-input encoders shall also provide for a single, line level audio output.

K. The video encoder shall provide for 1 alarm input per camera input. The encoders shall also provide a single relay output per unit.

L. The 1- and 2-input encoders shall support looping video outputs with software-controlled termination.

M. The video encoder shall support PTZ cameras by way of Coaxitron or Pelco D protocol through a serial connection to the RS422 port.

N. When used with Endura, the video encoder shall be capable of digitally signing each frame of video to guarantee the authenticity of digital video all the way back to its source.

O. The video encoder shall support SNMP diagnostic messages and traps and shall be compliant with SNMP versions 1 and 2.

P. The video encoder shall use a standard web browser interface for remote administration and configuration of encoder and camera settings. The browser interface shall support multi-screen remote monitoring for cameras attached to other encoders or Pelco cameras with Sarix technology on the same network subnet.

Q. The network camera shall provide an additional processor for running Pelco Video analytics.
1. Pelco Analytic Suites shall be configured and enabled using a standard Web browser.
2. Pelco Analytic Suites shall allow remote operation and alarm notification when used with an Endura system or a third-party system that supports Pelco's Analytics API.
3. Pelco Analytics for Network Encoders including:
   a. Abandoned Object: Detects objects placed in a defined zone and triggers an alarm if the object remains in the zone longer than the user-defined time allows. An airport terminal is a typical installation for this behavior. This behavior can also detect objects left behind at an ATM, signaling possible card skimming.
   b. Adaptive Motion: Detects and tracks objects that enter a scene and then triggers an alarm when the objects enter a user-defined zone. This behavior is primarily used in outdoor environments with light traffic to reduce the number of false alarms caused by environmental changes.
   c. Camera Sabotage: Detects contrast changes in the field of view. An alarm is triggered if the lens is obstructed with spray paint, a cloth, or a lens cap. Any unauthorized repositioning of the camera also triggers an alarm.
   d. Directional Motion: Generates an alarm in a high traffic area when a person or object moves in a specified direction. Typical installations for this behavior include an airport gate or tunnel where cameras can detect objects moving in the opposite direction of the normal flow of traffic or an individual entering through an exit door.
   e. Loitering Detection: Identifies when people or vehicles remain in a defined zone longer than the user-defined time allows. This behavior is effective in real-time notification of suspicious behavior around ATMs, stairwells, and school grounds.
   f. Object Counting: Counts the number of objects that enter a defined zone or cross a tripwire. This behavior might be used to count the number of people at a store entrance/exit or inside a store where the traffic is light. This behavior is based on tracking and does not count people in a crowded setting.
   g. Object Removal: Triggers an alarm if an object is removed from a defined zone. This behavior is ideal for customers who want to detect the removal of high value objects, such as a painting from a wall or a statue from a pedestal.
   h. Stopped Vehicle: Detects vehicles stopped near a sensitive area longer than the user-defined time allows. This behavior is ideal for airport curbside drop-offs, parking enforcement, suspicious parking, traffic lane breakdowns, and vehicles waiting at gates.
4. Pelco Analytic Suites shall be preloaded or configuration and alarm notification when used with an Endura® system or a third-party system that supports Pelco's Analytics API.
5. Multiple Pelco behaviors can be scheduled to work during a certain time or condition.

R. ObjectVideo® Analytics for EP High Definition Digital Network Cameras

1. ObjectVideo (OV) intelligent video analytics technology shall be embedded in Pelco EP network cameras with Sarix technology, enabling rule configuration and alarm notification when using OV Ready™ systems.
2. OV analytics shall be made available in three suites: OV Security Suite, OV Security Suite Plus and OV Event Counting Suite. These suites shall provide a spectrum of settings to allow use of the behaviors in a variety of applications. The technology shall help users identify situations of interest, such as surveillance and business effectiveness analysis.
3. OV Security Suite shall include Tripwire Detection, Inside Area Detection, and Camera Tamper Detection behaviors: Tripwire Detection shall identify objects that cross a user-defined line drawn within the camera's field of view; Inside Area Detection shall identify

objects entering, appearing, or moving within a user-defined area; and Camera Tamper Detection shall detect changes in the camera field of view, including obstruction of lens (such as by cloth, spray paint, or a lens cap cover) and unauthorized movement of the camera.

4. OV Security Suite Plus shall include (in addition to all behaviors of the Security Suite) Multi-Line Tripwire Detection, Loitering Detection, and Leave Behind Detection behaviors: Multi-Line Tripwire Detection shall track objects that cross two defined lines, which can be defined by parameters such as direction, sequential order, and the time it takes to cross both tripwires; Loitering Detection shall analyze how frequently people remain for a specified period of time within a defined area, allowing for real-time notification of suspicious behavior around ATMs, stairwells, and school grounds; and Leave Behind Detection shall detect objects placed in a defined zone and trigger an alarm if the object remains in the specified zone longer than the user-defined time allows.
5. OV Event Counting Suite shall use advanced object calibration and additional features for schedules, parameters, and multiple rules. The suite shall include behaviors for Tripwire Counting, Enters/Exits Counting, Loiter Counting, Occupancy Sensing, and Dwell-Time Monitoring: Tripwire Counting shall count people or objects that cross a user-defined line; Enters/Exits Counting shall calculate the number of people that enter and exit an area without using a tripwire; Loiter Counting shall calculate people who stop in front of a defined area of interest (such as a display or product); Occupancy Sensing shall count people, generating a new value every time the occupancy level changes and time stamping each occupancy output, allowing the data to be used to determine average occupancy levels or to correlate data to point-of-sale or other business scenarios; and Dwell-Time Monitoring shall determine the time between which an object enters and exits an area, provide queue size information, and allow assessment of wait times.

S. Model Number
   1. Pelco NET5400 series, Video Encoders

2.4 INDOOR DIGITAL (IP) NETWORK MINI DOME CAMERAS

A. Shall be Pelco IMS0LW10-1 Sarix indoor fixed IP mini dome camera with SureVision, 0.5 Mpxl, low-light, WDR, day/night, 2.8~10mm varifocal megapixel lens, clear dome

2.5 EXTERIOR (WEATHERPROOF) DIGITAL (IP) NETWORK MINI DOME CAMERAS

A. Shall be Pelco #IM10DN10-1E Sarix environmental, indoor/outdoor mini fixed dome IP camera 1.3 Mpxl, day/night, 2.8~10mm varifocal megapixel lens, clear dome with #WMVE-WR/IM-VEPM vandal-resistant wall-mount with pendant accessory

2.6 HIGH DEFINITION CCTV MONITOR

A. The CCTV monitor shall offer the following features: VGA, DisplayPort, and digital visual interface (DVI) inputs, looping BNC output, full high definition resolution, and 32” (minimum) LCD display.

B. The LCD monitor shall provide picture-in-picture (PIP) capability.

C. The Narrow Bezel LCD monitor shall be capable of providing a minimum of 1920 x 1080p native resolution.

D. Model Number
1. Pelco PMCL532F with PMCL-WMT tilt/swivel wall mount

2.7 EQUIPMENT RACKS

A. All digital recorders, video encoders, patch panels and other similar equipment shall be mounted in standard data racks at telephone backboards. CCTV system supplier may utilize space within rack furnished by the Structured Cabling Contractor if available, or may furnish a separate wall-mounted, hinged rack meeting the requirements of the Structured Cabling System specifications section.

2.8 CABLING

A. All Ethernet cabling to cameras shall be yellow, Cat6.

B. Refer to plans and the following specifications sections for cabling requirements:
1. Section 27 05 00: Auxiliary System Cables, 0-50V
2. Section 27 10 00: Structured Cabling System

2.9 MISCELLANEOUS AND OTHER EQUIPMENT

A. Furnish all miscellaneous hardware, connectors, wire/cable and components required for complete functioning system.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Work under this section shall be of professional quality with emphasis on neatness and workmanship.

B. Guarantee workmanship and/or material executed under this division for three (3) years after final acceptance. In the event that project is occupied or systems placed in operation in several phases at Owner's request, guarantee will begin on date each system or time of equipment is accepted by Owner.

C. Focal length of lenses for various cameras shall be determined on site, as well as exact positions of camera. Contractors shall supply portable equipment, camera, monitor, and assorted lenses for field test to make determinations. Test shall be scheduled with, and made in the presence of, the Owner's Representative and the Engineer.

D. All Cat6 cabling shall be installed by the Structured Cabling Contractor per Specification Section 27 10 00. Refer to Specification Sections 27 05 00 and 27 10 00 for additional cable installation requirements.

3.2 OBSERVATIONS OF WORK AND DEMONSTRATION OF OPERATION:

A. Final inspections shall include, but are not limited to, a demonstration to the Engineer and Owner's Representative of all functions and controls of system being tested. Architect's column on test plan will be executed during final. Sufficient Sub-Contractor personnel shall be on site to demonstrate systems. Personnel shall be knowledgeable about all system hardware and software where applicable.

END OF SECTION 28 20 00

SECTION 28 31 00

FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall furnish and install a complete low voltage, automatic and manual fire alarm system as specified herein and indicated on the drawings.

B. The system shall include a central control panel, power supply, signal initiating devices, audible and visual alarm devices, a conduit and wiring system and all necessary accessories required to provide a complete operating system.

C. The system shall be completely addressable.

D. The system shall comply with the applicable provisions of the National Fire Protection Association Standard Number 72 (National Fire Alarm Code) for fire alarm systems; N.E.C. Article 760; and meet all requirements of the local authorities having jurisdiction.

E. The system shall be provided by a local service organization located within 50 miles of the job site.

1.2 DESCRIPTION OF SYSTEM

A. Conduit, outlet boxes, cabinets, devices and wiring installation for complete fire detection and alarm system.

B. Each and every item of the Fire Alarm System shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriter's Laboratories, Inc. (UL), and shall bear the "UL" label. All control equipment shall be listed under UL category UOBZ as a single control unit. Partial listing shall not be acceptable. System controls shall be UL listed for Power Limited Applications per N.E.C. Article 760. All circuits shall be marked in accordance with N.E.C. 760-23.

C. Wiring shown is diagrammatic to define system and is not intended to show every wire. Review drawings prior to bidding and inform Contractor of any additional wiring necessary for installation of systems. Wiring shall comply with pathway survivability requirements defined in NFPA 72. Include cost of all wiring in bid.

D. Submit complete shop drawings of system for review including terminal to terminal connection diagrams for system components and associated equipment interfaces, conduit diagrams, complete descriptive information on each item of equipment including UL listing for all system components, and any other information required by Architect to describe system. Identify color code and terminal numbers on shop drawings.

E. After completion of work, submit one set of record mylar sepias with items for Owner described above. Typical type drawings will not be accepted.

F. Manufacturer's trained technical representative shall supervise installation, connections and tests. The authority having jurisdiction shall be notified prior to installation or alteration of equipment or wiring. Before acceptance, manufacturer's representative will test and certify in writing that system is installed and functioning properly as intended by drawings and specifications. Test includes operation of all devices in entire system.

G. Guarantee entire system in writing for one year from date of acceptance by Owner. Guarantee will cover completely all components, equipment, wiring, etc. Repair any defects found in the system within the guarantee period without cost to owner.

H. Submit with bid a guaranteed price for complete maintenance and service of system for one year beginning at expiration of guarantee period. Price shall be guaranteed for acceptance by Owner until date of substantial completion of system.

1.3 SYSTEM OPERATION

A. Actuation of any alarm initiating device shall cause all audible alarm signals to sound, all visual indicating appliances to flash, activate an alarm LED and local tone-alert at control panel/annunciator, cause an LCD read-out of point in alarm including type of alarm (smoke detector, manual station, etc.), provide a signal to the mechanical controls to shut down or re-route air handling systems according to established plans. This shall include a suitable addressable relay at each air handling unit to shut down all air handlers in a given zone when system goes into alarm.

B. The general alarm devices may be silenced by authorized personnel only, by entering a locked cabinet and operating the proper silencing switch. A subsequent zone alarm shall reactivate the signals. Operation of the silencing switch shall be indicated by a trouble light and audible signal.

C. Operation of any sprinkler monitoring switch, power failure, opens, grounds, or any disarrangement of the system wiring or components shall be indicated by a visual and audible trouble signal. The audible trouble signal may be silenced; however, the trouble LED shall remain lit until the system has been returned to normal operating condition.

D. Analog Smoke Sensor Operation
1. The smoke sensor shall be a smoke density measuring device having no self contained alarm set-point. The alarm decision for each sensor shall be determined by the control panel. The control panel shall determine the condition of each sensor by comparing the sensor value to stored values.
2. The control panel shall maintain a moving average of the sensors smoke chamber value. Systems that do not automatically maintain a constant smoke obscuration sensitivity for each sensor by compensating for environmental factors and are deemed unacceptable.
3. The system shall automatically indicate when an individual sensor needs cleaning. When a sensor’s average value reaches a predetermined value, a “Dirty Sensor” trouble condition shall be audibly and visually indicated at the control panel for the individual sensor. Additionally, the LED on the sensor base shall glow steady giving a visible indication at the sensor location.
4. If a “Dirty Sensor” is left unattended, and its average value increases to a second predetermined value, an “Excessively Dirty Sensor” trouble condition shall be indicated at the control panel for the individual sensor.

5. The control panel shall automatically perform a daily self-test on each sensor. Checking the electronics in the sensor's base ensures the accuracy of the values being transmitted to the control panel. A sensor which fails the self-test will cause a "Self Test Abnormal" trouble condition at the control panel. A sensor self-test which must be manually initiated by the operator shall not be acceptable.

1.4 SYSTEM FEATURES

A. The fire alarm system shall include the following features as a minimum:
1. Supervision of all field wiring.
2. Microprocessor based solid state modular construction.
3. Ground fault detection and ground fault isolating & supervising circuitry.
4. 80 character LCD display to indicate alarms, supervisory service conditions and troubles.
5. Simultaneous test of all LED's and LCD's from a central point.
6. "Dead Front" design control panel/annunciator with field programmable LED alarm, status and trouble indicators, and all control switches located behind a locked tempered glass door.
7. Fully automatic battery charger and lead alkaline batteries. Batteries shall have capacity to maintain system operation for 24 hours in normal supervisory mode and shall have sufficient capacity remaining to operate in alarm mode for 15 minutes at conclusion of supervisory period. Batteries shall be supervised for connection to the system and for low voltage threshold. Ammeter and voltmeter shall be provided to indicate battery voltage and charging current.
8. Two (2) sets of 2 amp form C auxiliary alarm contacts fused with feedback.
9. One (1) set of 2 amp form C auxiliary trouble contacts.
10. Standard with 127 addressable points (expandable to 508 points) and four input/output (I/0) circuits (expandable to 20 circuits).
11. Basic four (4) amp power supply (expandable as required).
12. 600 event historical logging.
13. System shall be field programmable for offsite monitoring by remote station reverse polarity, local energy master box or shunt master box types.
14. System shall be field programmable for signal circuit type of operation; march time code, temporal code, selective code, zone code, general alarm, time limit cutout and alarm silence inhibit.
15. System shall be field programmable for waterflow/sprinkler supervisory operation on distinct zones as required.
16. Transient suppression protection shall be provided on the system power supply and on the municipal protection circuit to comply with UL 864 requirements. Additionally, surge suppression shall be provided within the control panel on all circuits that extend outside the building (including to roof-mounted HVAC units).
17. Supervised remote annunciator connection circuit.
18. System shall incorporate an alarm/trouble walk test.
19. Resident non-volatile programmable operating system memory for all operating requirements.

PART 2 - PRODUCTS

2.1 FIRE ALARM CONTROL PANELS/ANNUNCIATORS

A. Furnish and install Simplex type 4020-9101 fire alarm control panel(s) with options and accessories as required.

2.2 MANUAL ALARM STATIONS

A. Manual alarm stations shall be Simplex addressable type 4099-9002 break glass (double-action). The station body shall be so constructed that chips and scratches will not expose metal. All stations shall be master keyed with the control equipment. When actuated, the "Pull Lever" shall remain at right angle to the station body until reset.

B. Boxes:
1. Recessed, two-gang outlet boxes with Simplex type 2099-9813 red, semi-flush trim plates shall be used where possible.
2. Where surface-mount outlet boxes are required, boxes shall be red, cast aluminum Simplex type 2975-9022.

2.3 PHOTOELECTRIC SMOKE SENSOR

A. The smoke sensors shall be of the photoelectric addressable Simplex type 4098-9714 and shall communicate actual smoke chamber values to the system control panel. The smoke sensors shall operate on the light scatter principle. For maximum maintenance free service and low power requirement, light source for detection chamber and visual alarm indication shall be solid state photodiode.

B. Each sensor base shall be visually and electrically supervised.

C. The sensors shall be listed to UL Standard 268 and shall be documented compatible with the control equipment to which they are connected. The sensors shall be listed for both ceiling and wall mount applications.

D. Each sensor base shall contain integral addressable electronics and an LED that will flash each time it is scanned by the control panel (once every 4 seconds). The control panel shall be responsible for drift compensation. When the control panel determines that a sensor is in an alarm or a trouble condition, the control panel shall command the LED on that sensor's base to turn on steady indicating the abnormal condition. Sensors which do not provide a visible indication of an abnormal condition at the sensor location shall not be acceptable. Sensor bases shall be compatible with detachable photoelectric, ionization and heat sensors so that these various sensor types can be easily interchanged to meet specific location requirements. Sensor base shall be addressable type as required.

E. Where required, sensor bases shall be provided with a relay driver output and supervised relay, which are to be controlled either automatically or manually from the control panel.

F. Each sensor base shall be scanned by the control panel for its type identification to prevent inadvertent substitution of the wrong sensor type. The control panel shall operate with the installed device but shall initiate a "Wrong Device" trouble condition until the proper type is installed or the programmed sensor type is changed.

G. Each sensor shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.

H. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.

I. Cover all smoke detection devices with plastic bags immediately after installation to maintain cleanliness, if field conditions so require.

J. Provide a U.L. listed sensor guard for sensors in areas subject to tampering. The guard shall be suitable for ceiling or sidewall mounting and hinged for easy access. The guard shall be securely mounted with tamper-proof screws.

2.4 PHOTOELECTRIC DUCT DETECTOR

A. The detector shall be an addressable, non-polarized 24VDC, Simplex type 4098-9755, which is compatible with the Fire Alarm Control Panel and obtains its operating power from the supervisory current in the fire alarm detection loop. It shall be of the same analog type as the ceiling smoke detectors. Detectors shall be of the solid state photoelectric type and shall operate on the light scattering, photodiode principle. To minimize nuisance alarms, detectors shall have an insect screen and be designed to ignore invisible airborne particles or smoke densities that are below the factory set alarm point. No radioactive material shall be used.

B. The detector head shall be directly interchangeable with an ionization detector type. The 24VDC detector may be reset by actuating the control panel reset switch.

C. Detector construction shall have a mounting base with a twist-lock detecting head that is lockable. The locking feature must be field removable when not required. Contract between the base and head shall be of the bifurcated type utilizing spring type, self-wiping contacts. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel.

D. Sampling tubes sized to match duct size as recommended by equipment manufacturer shall be provided with duct detectors as required.

E. Detector design shall provide compatibility with other normally open fire alarm detection loop devices (heat detectors, pull stations, etc.). It shall be possible to alarm the duct housing by using a test switch. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housings front cover.

F. To minimize false alarms, voltage and RF transient suppression techniques shall be employed as-well-as smoke signal verification circuit and an insect screen.

G. Separate auxiliary SPDT relays for fan shutdown shall be provided with each duct detector for fan shutdown, smoke evacuation or other purposes as indicated on plans.

H. Remote key operated test stations with LED alarm indicators shall be installed in an accessible, inconspicuous location for each duct detector.

I. Duct detectors shall be installed for the equipment as indicated on plans as follows (locations shown on plans are diagrammatical only):
   1. A minimum of six duct widths downstream from bends or inlets to avoid air turbulence.
   2. On the downstream side of filters to detect fires in the filters.
   3. In return ducts, ahead of mixing areas.
   4. Upstream of air humidifier and cooling coil.
   5. With accessibility for test and service.

J. The following duct detector locations shall be avoided:
1. Where dampers closed for comfort control would interfere with airflow.
2. Next to outside air inlets (unless the intent is to monitor smoke entry from that area).
3. In return air damper branch ducts and mixing areas where airflow may be restricted.

K. Where duct detectors are installed in exterior or wet locations, weatherproof duct housing enclosures shall be provided to protect the detectors. Enclosures shall be located to be in shaded areas rather than direct sunlight. Entire installation shall be as directed by the equipment manufacturer.

2.5 HEAT SENSORS

A. Heat sensors shall be U.L. listed, addressable Simplex type 4098-9733. They shall provide rate-of-rise temperature sensing, fixed temperature sensing (135 degrees F) and utility temperature sensing (32 degrees F to 155 degrees F range).

B. Each sensor base shall be visually and electrically supervised.

C. The sensors shall be listed to UL Standard 268 and shall be documented compatible with the control equipment to which they are connected. The sensors shall be listed for both ceiling and wall mount applications.

D. Each sensor base shall contain integral addressable electronics and an LED that will flash each time it is scanned by the control panel (once every 4 seconds). The control panel shall be responsible for drift compensation. When the control panel determines that a sensor is in an alarm or a trouble condition, the control panel shall command the LED on that sensor's base to turn on steady indicating the abnormal condition. Sensors which do not provide a visible indication of an abnormal condition at the sensor location shall not be acceptable. Sensor bases shall be compatible with detachable photoelectric, ionization and heat sensors so that these various sensor types can be easily interchanged to meet specific location requirements. Sensor base shall be addressable type as required.

E. Where required, sensor bases shall be provided with a relay driver output and supervised relay, which are to be controlled either automatically or manually from the control panel.

F. Each sensor base shall be scanned by the control panel for its type identification to prevent inadvertent substitution of the wrong sensor type. The control panel shall operate with the installed device but shall initiate a "Wrong Device" trouble condition until the proper type is installed or the programmed sensor type is changed.

G. Each sensor shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.

H. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.

I. Heat sensor shall be automatically restorable.

2.6 MAGNETIC DOOR HOLDERS

A. Provide Simplex type 2088 series magnetic door holders as required where shown on plans.

2.7 ALARM SIGNALS (AUDIBLE)

A. Horns:
1. Alarm horns shall be Simplex type 4901-9820. The horns shall be polarized and shall be operated by 24 VDC. Each horn assembly shall include separate wire leads for in/out wiring for each leg of the associated signal circuit. T-tapping of signal device conductors to signal circuit conductors shall NOT be accepted. Where horns are shown as a combination audio-visual assembly, they shall be mounted as a combination unit in a single back box (4903 series) . Horns shall be capable of producing 95 dB.

B. Electronic Chimes:
1. Electronic chimes shall be Simplex type 2902 series. The chime shall be polarized and shall be operated by 24 VDC with a minimum of 82 dB at 10 ft. Adaptors shall allow surface, semi-flush, weather resistance, or audio/visual mounting as shown on the plans.
2. Chimes shall have field adjustable volume control. They shall be provided with four (4) connections to insure properly supervised in/out system connection. Chime shall be U.L. listed for its intended purpose. Where chimes are shown as a combination audible-visual assembly, they shall be mounted as a combination unit with an adapter in a single back box.

C. Devices required to be surface mounted shall be furnished with Simplex type 2975-9145 surface mounting box and 4905-9903 adaptor plate.

D. Devices installed in areas subject to mechanical damage (ie. gymnasiums) shall be furnished with suitable wire guards as indicated on plans.

2.8 ALARM SIGNALS (VISUALS)

A. Visual Flashing Lamps (Xenon Strobe):
1. Furnish and install per plans and specs Simplex type 4904 series visible appliance for fire alarm system notification. The appliance shall be 1HZ synchronized (15cd, 30cd, 110cd) with polar distribution or 75 cd illumination as required by the Americans with Disabilities Act (ADA). The appliance shall be U.L. listed to Standard 1971 and have a circumpolar light output allowing mounting in either vertical or horizontal positions or on the ceiling.
2. The light unit shall be of ABS polycarbonate and the lens of high grade, optical quality LEXAN. For optimized light distribution, the xenon flash tube shall be installed perpendicular to the appliance's back plane. A special compound reflector shall be utilized to maximize and best distribute the light pattern in key axis directions.
3. The effect of the illuminated visible appliance shall be observable in a circumpolar pattern. The visible appliance shall be labeled with the word "FIRE" in a contrasting color and the height of each character shall be a minimum of 5/8 inches. In its quiescent state, the word "FIRE" shall be visible.
4. Mounting heights of visual appliances shall in all respects comply with the Americans with Disabilities Act.
5. Visual indicating appliances shall be Simplex type 4904 series and comprised of a Xenon flashtube and be entirely solid state. These devices shall be U.L. listed and be capable of either ceiling or wall mounting. The LEXAN lens shall be pyramidal in shape to allow better visibility. Visual units shall be of the stand alone type.

2.9 REMOTE ANNUNCIATOR

A. Where shown on the plans, provide and install an LCD annunciator. The annunciator(s) shall have a stainless steel finish and shall provide the same functionality as the main control panel front panel display. The annunciator shall communicate to the control panel over one twisted shielded pair of wire and operating power shall be 24VDC and be fused at the control panel. Point-wired annunciators will not be considered as equal.

B. The serial annunciator shall provide a common alarm and trouble circuit consisting of:
1. Control push-button switches – for alarm silence, trouble silence, system reset and manual evacuation duplicating the control panel switches. A key "enable" switch shall be provided to activate or deactivate the control switches.
2. Tone Alert – Duplicates the control panel tone alert during alarm and trouble conditions.
3. System trouble LED.
4. Power on LED.

C. To accommodate and facilitate job site changes the control switches shall have the capability to be programmed on site to provide for manual switch input operation other than their standard purpose.

2.10 SPRINKLER FLOW SWITCHES

A. Sprinkler flow switches and supervisory switches are provided under another section of these specifications. This contractor shall be responsible for electrical connection of these devices to the fire alarm system.

2.11 SMOKE DAMPERS

A. Smoke dampers are provided under another section. This contractor shall be responsible for supplying a source of power and connecting them to the fire alarm system to close on alarm.

2.12 SYSTEM RECORD DOCUMENT CABINET

A. Furnish and install a documentation cabinet at the system control unit or other approved location. All final record documentation shall be stored in the cabinet. Cabinet shall be labeled as "SYSTEM RECORD DOCUMENTS". Cabinet shall include a 4 gigabyte digital flash drive interface with USB connector loaded with a digital copy of all system documentation including shop drawings and product data.

2.13 OFF SITE MONITORING

A. Furnish all material and labor to accomplish and coordinate with local company or fire department as necessary for off site monitoring of the Fire Alarm System. Transmission method(s) shall be as required by applicable codes and Authority Having Jurisdiction (AHJ). Off site monitoring shall be in operation prior to final acceptance. Exact type of off site monitoring (basic reporting or advanced reporting as described below) shall be provided by the contractor per the owner's direction.

B. Furnish and install serial digital alarm communicating transmitter (DACT), capable of reporting specific alarm points to the central station. DACT shall be universal in that it can be utilized to either provide basic reporting (alarm, trouble, supervisory conditions) or more advanced reporting (point-to-point reporting of specific alarm conditions) DACT shall be mounted integral to or beside fire alarm control panel.

2.14 FIRE ALARM CABLING

1. All fire alarm cabling shall:
   a. Have red outer insulation/jacket with ripcord.
   b. Be listed and labeled for the intended use in Fire Alarm systems.
   c. Where Level 2 or Level 3 pathway survivability is required by NFPA 72, cabling shall be 2-hour fire rated circuit integrity (CI) type.
   d. Be manufactured by West Penn, Allied, Belden or Superior Essex.

2.15 FIRE ALARM SYSTEM MANUFACTURER

A. All equipment shall be listed by UL. All panels and peripheral devices shall be the standard equipment of a single manufacturer and shall display the manufacturer's name on each component. Manufacturer's numbers specified in this section are those of Simplex Time Recorder Company to denote type, quality, material and desired operating features to be furnished.

B. Equipment shall be as manufactured by Simplex, Notifier or EST.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide and install the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations.

B. The contractor shall provide 120VAC power to all remote booster power supplies, control panels, transponder cabinets or other similar items as required. Where the project is provided with emergency power from an emergency generator, all power supplies shall be connected to an emergency source. Dedicated branch circuit(s) shall be provided to supply primary power to the fire alarm system. The associated branch circuit breakers shall be furnished with lock-on hardware and shall be identified with red marking as a fire alarm circuit. The location of the circuit disconnecting means shall be permanently identified at the fire alarm control unit.

C. All wiring shall be installed in strict compliance with all the provisions of NEC - Article 760 Parts I and III, Power-Limited Fire Protective Signaling Circuits or if required may be reclassified as non-power limited and wired in accordance with NEC-Article 760 Parts I and II.

D. All wiring shall be installed in strict compliance with pathway survivability requirements of applicable codes including NFPA 72.

E. Upon completion, the contractor shall so certify in writing to the owner and general contractor.

F. Front surface of all junction box covers in concealed areas (such as above lay-in ceilings) or within mechanical/electrical rooms (and other similar areas where appearance of boxes is not an issue) shall be sprayed red and labeled "Fire Alarm" or “F/A”. Covers in exposed areas shall be labeled “F/A” on interior of front cover. Wiring color code shall be maintained throughout the installation.

G. All fire alarm wiring shall be installed in conduit. Conduit shall be sized per manufacturer’s recommendations, but in no case shall conduit be smaller than 3/4”.

H. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate subcontractors.

I. All raceways shall be concealed unless specifically shown or approved otherwise.

J. The contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation.

K. Install System Record Document cabinet adjacent to control panel unless alternate location is approved.

L. The manufacturer's authorized representative shall provide on-site supervision of installation and shall provide all system setup and programming services.

M. The manufacturer’s authorized representative shall have as a minimum, a NICET LEVEL III certification. The fire alarm contractor shall have a technician with a minimum Nicet Level III certification working in a position of responsibility. All technicians working for the certified contractor shall have a minimum Nicet Level II certification. Any fire alarm contractor wishing to bid on the fire alarm work shall show evidence of certifications at the pre-bid conference.

N. The fire alarm contractor shall be licensed as a certified fire alarm contractor by the state in which the work is to be performed in compliance with all requirements of state fire marshall or other AHJ’s as applicable.

O. The drawing/specifications included herein are to indicate contract intent only. The Fire Alarm contractor shall provide final design documents to include plans specifying exact device types/locations, circuitry, battery calculations, circuit/voltage drop calculations, etc. in accordance with all applicable code requirements. These final design documents shall be prepared under the supervision of an engineer licensed in the state where the work is to be performed, engaged/employed by the Fire Alarm contractor, and must bear the engineer’s licensure seal with signature and date.

3.2 TESTING

A. The completed fire alarm system shall be fully tested in accordance with NFPA-72H by the contractor in the presence of the owner's representative and the Local Fire Marshal. Upon completion of a successful test, the contractor shall so certify in writing to the owner and general contractor, and shall submit final testing results with O&M documentation..

B. The contractor shall test and demonstrate proper operation of all smoke detection equipment and associated HVAC controls to the satisfaction of the authority-having-jurisdiction and fire marshal.

3.3 WARRANTY

A. The contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the completed and certified test or from the date of first beneficial use.

B. The equipment manufacturer shall make available to the owner a maintenance contract proposal to provide a minimum of two (2) inspections and tests per year in compliance with NFPA-72H

guidelines.

3.4 CERTIFICATION & ACCEPTANCE

A. A factory trained representative of the manufacturer shall supervise final testing of the system in accordance with N.F.P.A. Standard 72H-1984 in the presence of a representative of the authority having jurisdiction. Manufacturer's representative shall be NICET trained and shall have a level III NICET certificate. It shall be subject to the approval and acceptance of the responsible engineer. On completion of the acceptance tests, the Owner or his representative shall be instructed in the operation and testing of the system.

B. The fire alarm system shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of acceptance or beneficial occupancy whichever is earlier. Any equipment shown to be defective in workmanship or material shall be repaired, replaced, or adjusted free of charge.

C. The equipment manufacturer shall be represented by a local service organization, and the name of this organization shall be furnished to the Architect and Owner. The service organization shall be located within 50 miles of the job site. The service organization shall furnish, gratis to the Owner, a one year maintenance warranty contract, effective from the date of final acceptance.

END OF SECTION 28 31 00

SECTION 28 78 00

EMERGENCY RESPONDER RADIO COVERAGE SYSTEM

PART 1 - GENERAL

1.1 INITIAL RADIO SIGNAL SURVEY (INCLUDE IN BASE BID)

A. Include all costs in base bid for the Fire Alarm Contractor to conduct a radio signal survey immediately after building structure is complete, and prior to ceiling installation to determine signal coverage and strength of the municipality's emergency responder radio (public safety) system inside the project facility.

B. Conduct a survey using a RF Spectrum Analyzer, a calibrated, system-compatible radio or another suitable instrument with traceable certificate of calibration to analyze the RF signal strength. Both inbound and outbound signal strength shall be determined, measured, calculated and documented as required by code and AHJ. Survey shall be performed by FCC GROL certified technicians. Survey shall include measurements at a minimum of 20 readings per floor or 1,600SF if the floor area exceeds 32,000SF and in all critical areas or as otherwise directed by AHJ.

C. Survey report and drawing indicating measurements at each frequency band of interest shall be submitted to the AHJ for review. The report shall clearly indicate all areas that do not meet a minimum of -95dBm nominal uplink or downlink signal at 100% or a Delivered Audio Quality (DAQ) of 3.0.

D. If measured levels determined to be insufficient, a complete Emergency Responder Radio Coverage (ERRC) system shall be provided in accordance with these specifications below. Cost for the system and installation will be paid through allowance.

E. Contractor shall be responsible for scheduling survey so that all of the following is completed prior to the installation of ceilings:
1. Conduct initial survey
2. Submit survey results and report to the AHJ for review and determination of system requirements
3. Provide system design and submit shop drawings to architect and AHJ for review

1.2 SCOPE (SEE ALLOWANCES)

A. The contractor shall design, furnish, install, and warranty a complete Emergency Responder Radio Coverage (ERRC) system. The installed system shall include all hardware, bi-directional amplifiers, band-pass filters, surge suppressors, lightning protection, UPS, transmission lines, power cabling, antennas, and other components necessary for a complete operational system as specified and as acceptable to the local authorities having jurisdiction.

B. Equipment manufacturer name and model numbers specified are provided to establish quality of equipment and system operational features. Any proposed substitution of equipment from that specified must be approved by the Architect within ten (10) days prior to bid date.

C. The entire system shall be guaranteed for a period of one (1) year from the date of final

acceptance of the installation and the Contractor shall repair or replace defective equipment, during this period, at no cost to the owner.

D. Entire system shall be verified and approved by local AHJ to comply with all emergency responder radio network requirements including signal strength and frequency range.

1.3 DEFINITIONS

A. BDA: Bi-Directional Amplifier is a two-way signal booster that is used to amplify band-selective or multi-band RF signals in the uplink, to the base station and in the downlink from the base station to subscriber devices for enhanced signals and improved coverage.

B. DAS: Distributed Antenna System is a network of separate antenna nodes connected to a common transport medium.

C. ERRC: Emergency Responder Radio Coverage System is a complete in-building radio communication system that brings wireless signals into a structure from outside, amplifies those signals with a signal booster (BDA), and then evenly distributes the amplified signals throughout a structure via a Distributed Antenna System (DAS). The system also amplifies signals originating inside the building and transmits them outside.

D. Donor Antenna: Antenna that receives and transmits signal to radio system outside of facility.

1.4 STANDARDS

A. The system shall comply with all requirements of the latest edition of each of the following codes and standards. The latest edition of these codes and standards form a part of this specification:
1. U.L. Standard 2524.
2. International Fire Code Section 510
3. NFPA 1221
4. NFPA 72
5. All requirements of local Fire Department, Building Department and all other authorities having jurisdiction (AHJ)

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For headend and distribution system. Include plans, elevations, sections, details and attachments to other work.
1. Show fabrication and installation details for equipment.
2. Functional Block Diagram: Show single-line interconnections between components for headend and distribution system. Show cable types and sizes.
3. Dimensioned Plan and Elevations of Headend Equipment: Show access and workspace requirements.
4. Wiring Diagrams: For power, signal, and control wiring and transmission cable, include cross connects, taps, and other connections cords.

C. Design Calculations: Calculate signal attenuation budget and show calculated line and equipment losses for the system based on the functional block diagram, to show that proposed

system layout can be expected to perform up to specification. Calculate signal strength from sources to endpoints. Allowable losses between components and user interface shall be used to determine size and type of cable.

D. Coordination Drawings: Include dimensioned plan and elevation views of components and enclosures. Show access and workspace requirements.

E. Equipment List: Include each piece of equipment and include model number, manufacturer, serial number, location, and date of original installation. Insert testing record of each piece of adjustable equipment, listing name of person testing, date of test, and description of as-left set points.

F. Field quality-control reports.

G. Operation and Maintenance Data: For headend and distribution system to include in emergency, operation, and maintenance manuals.

H. Contract shall submit set of all drawings and product data to permitting agencies as required. These final design documents shall be prepared under the supervision of an engineer licensed in the state where the work is to be performed, engaged/employed by the system vendor, and must bear the engineer's licensure seal with signature and date.

I. Any permits necessary for the installation of the work shall be obtained prior to the commencement of the work. All permit costs and inspection fees shall be included.

PART 2 - PRODUCTS

2.1 RADIO FREQUENCY (RF) BDA-BASED SIGNAL BOOSTER SYSTEMS

A. In-building signal booster systems shall receive and re-transmit the entire uplink/downlink frequency band utilized by the regional emergency service provider(s)**.** The contractor shall confirm with the regional emergency service provider(s) as to the specific frequencies used by the various agencies. This system shall be state-of-the-art, operating bi-directionally and in full duplex. The system shall be fully compatible with and function on Locality's Public Safety Radio System.

B. BDA shall be capable of providing in building coverage for all the cellular networks as identified by the owner.

C. Signal boosters (BDA)
1. Shall have Nema Type 4 enclosure
2. Shall be UL2524 listed
3. Shall be FCC certification.
4. Provide standby battery system capable of maintaining the system operational for a minimum of 12 hours or 2 hours if supplied by emergency generator circuit. Batteries system shall be completely enclosed in Nema Type 4 enclosure.
5. Signal Boosters shall have oscillation suppression circuitry to protect the public safety radio system in case of system malfunction or other causes. The oscillation suppression circuit shall not disable the system operation. Systems that automatically disable the signal booster upon oscillation detection shall not be allowed

6. Signal Boosters shall have uplink noise suppression function to eliminate uplink noise while in standby (i.e. no radio transmission from within a building).
7. Include relays as required for monitoring system with fire alarm system.

D. DAS Antennas shall be architectural, dome or flush type where located in public areas. Stick type antennas are acceptable where located in back-of-house spaces. Finish shall be white unless directed otherwise by architect in submittal review.

E. A dedicated supervised monitoring panel shall be provided next to the fire alarm panel / annunciator or other location as designated by AHJ to annunciate the status of all signal booster locations. The monitoring panel shall provide visual and labeled indication of the following for each signal booster:
1. Normal AC power
2. Signal booster trouble
3. Antenna Failure
4. Loss of normal AC power
5. Failure of battery charger
6. Low battery capacity

F. Completed installations (including cabling) shall comply with all applicable codes and standards, including County Building and Electrical Codes, NFPA, ANSI, NEC, OSHA, EIA, IEEE, R-56, etc., as well as the FCC Rules and Regulations, as applicable. Equipment provided shall be UL listed and FCC type accepted for this specific application. Compliance to codes and standards shall extend to include proper grounding, bonding and surge.

G. All cabling shall be plenum rated.

H. All vertical riser cabling shall be 2-hour rated.

2.2 DESIGN REQUIREMENTS:

A. The system shall provide digital signal strength coverage over 95% area on each floor/level of the equipped building, or in specific areas defined by Locality in a Scope of Work document for a particular building or site. Critical areas shall have 99% floor area coverage.

B. Systems shall provide a minimum digital and analog overage of Circuit Merit (CM) 3 and Delivered Audio Quality (DAQ) 3.0, with a reliability factor of 95%.

C. Antenna isolation shall be maintained between the donor antenna and all inside antennas (D.A.S.) to a minimum of 20dB under all operating conditions

D. A Coverage Acceptance Test shall be executed prior to final acceptance of an installed system. Coverage acceptance testing shall be based on audio quality performance in evenly spaced test grids in the defined service areas. A minimum of 20 tests will be taken per floor/level. Total number of test grids will be determined by the Owner, based on the size of the space per floor/level.

E. Design and appearance will be of “finished” construction, i.e. shall be concealed and/or unobtrusive in finished areas. DAS antennas shall be located in back-of-house areas where possible. If required to be located in visible public aeras, antennas shall be architectural, low-

profile type and located in corridors where possible. Unless indicated otherwise, wire mold and surface conduit installations will not be acceptable unless approved in writing by the Architect in advance.

2.3 MANUFACTURER

A. Equipment shall be as manufactured by Simplex, Notifier or EST or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wiring shall be in strict accordance with the National Electrical Code and all state and local regulations. Wiring shall be installed in accordance with manufacturer's wiring diagrams and shall test free from ground, opens and short circuits.

B. All connections shall be made under the direct supervision of a qualified technician.

C. Contractor shall provide dedicated power circuits as required for system operation. Where an emergency distribution system is provided, radio coverage system power shall be connected to the emergency branch.

D. All vertical riser cabling shall be installed in conduit within a 2-hour fire rated enclosure.

E. All copper circuits routed between or outside of buildings shall be provided with a surge protection device at each end.

F. Securely mount donor antenna on roof and aim towards direction of public safety city repeater antenna. All mounting and penetrations shall be coordinated with roofing contractor.

G. Contractor shall provide all devices and cabling as required to monitor system with building Fire Alarm System in accordance with all applicable code requirements.

H. Refer to Specification Section 27 05 00 for additional installation requirements.

I. During initial installation, each system shall be optimized to perform in accordance with the specifications set forth in the system design, manufacturer's specifications and FCC regulations. The contractor shall ensure that uplink and downlink levels are properly set and consistent with design expectations. The contractor shall further ensure that noise and spurious products are held within limits set forth in the system design, manufacturer's specifications and FCC regulations. Prior to system acceptance, for each active BDA, booster amplifier, etc., the contractor shall submit a Proof of Performance certification, that lists the design expectations, actual measurements, and if applicable, FCC specifications for the following parameters:
   1. Worst case BDA uplink input level, in dBm.
   2. Worst case BDA uplink output level, in dBm.
   3. BDA downlink input level, in dBm.
   4. BDA downlink output level, in dBm.
   5. Noise and spurious products, BDA uplink output, in dBc.
   6. Noise and spurious products, BDA downlink output, in dBc.

J. The original Proof of Performance report shall be submitted to Owner's project manager, and a copy of the Proof of Performance report shall be affixed to its associated equipment.

3.2 WARRANTY

A. The contractor shall provide a full one-year warranty to cover installation and all equipment, software, and components; the warranty shall commence upon the Owner's final acceptance of the facility. Under warranty coverage, the successful contractor shall provide same business day response time for system malfunctions.

B. The contractor shall perform optimization of each system during the initial warranty period, sixty (60) to ninety (90) days prior to warranty expiration. This optimization task is separate from the initial optimization performed during system installation. The contractor shall include pricing for annual system optimization to be included as part of post-warranty maintenance. Actual scope of work for annual optimization and maintenance will vary on a case-by-case basis, but typically will consist of the following:
1. Optimize the system to perform in accordance with the specifications set forth in the system design, manufacturer's specifications and FCC regulations.
2. Ensure that uplink and downlink levels are properly set and are consistent with design specifications.
3. Ensure that noise and spurious products are held within limits set forth in the system design, manufacturer's specifications and FCC regulations.

C. Update the Proof of Performance records for the system, listing the design expectations, actual measurements, and if applicable, FCC specifications for the following parameters:
1. Worst case BDA uplink input level, in dBm.
2. Worst case BDA uplink output level, in dBm.
3. BDA downlink input level, in dBm.
4. BDA downlink output level, in dBm.
5. Noise and spurious products, BDA uplink output, in dBc.
6. Noise and spurious products, BDA downlink output, in dBc.

D. The updated Proof of Performance report shall be submitted to the Owner, and a copy of the updated Proof of Performance report shall be affixed to its associated equipment.

E. Visually inspect outside antenna installation. Correct any issues found with the antenna mounting hardware, grounding system, or outside cabling.

F. Visually inspect inside BDA or booster amplifier equipment installation. Correct any issues found with RF cabling, electrical connection, or equipment mounting.

G. Clean equipment fans, filters and other ventilation system components.

H. Inspect and replace any defective indicator lights.

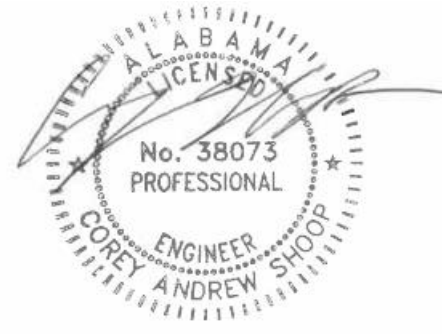
I. Test battery system performance for proper fallback to battery power and the duration of battery operation.

J. Test fault reporting system for proper operation and reporting of system faults.

K. Submit a written Preventive Maintenance Report to the Owner, listing the results of the optimization and preventive maintenance effort. The report shall include the Proof of Performance report for active RF components, and details of any other discrepancies found and corrective actions taken.

L. All as-built drawings shall be submitted to the Owner at completion, which shall include antenna system layout and all associated hardware, along with specification sheets. Include RF measurements taken.

END OF SECTION 28 78 00



4/27/2026

Applicable for Sections: 02 4100, 31 1000, 31 2000, 31 2500, 32 1216, 32 1313, 32 1613, 32 1723, 33 1000, 33 3000 and 33 4001

SECTION 31 1000

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related work specified elsewhere includes Sections:
.. Section 31 2000 - “Earth Moving”
.. Section 02 4100 - “Demolition”

1.2 SUMMARY

A. This Section includes the following:

1. Protection of existing trees and landscaping to remain, if any, and boundary and property line markers, bench marks, survey control points, and existing structures and improvements which are to remain.

2. Environmental and erosion control measures, as indicated and as otherwise required by applicable codes, regulations, and authorities having jurisdiction.

3. Removal of trees and other vegetation, as indicated, and within “controlled areas.”

4. Topsoil stripping, and stockpiling, as indicated, and within “controlled areas.”

5. Removing above-grade improvements as indicated, and as required to accommodate new construction.

6. Removing below-grade improvements as indicated, and as required to accommodate new construction.

1.3 PROJECT CONDITIONS

A. Traffic: Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction, unless specifically indicated elsewhere in contract documents.

B. Protection of Existing Improvements:

1. Provide protection necessary to prevent damage to existing improvements indicated to remain in place. Clearing, demolition and any excavation within 5'-0" of existing buildings and structures to remain shall be performed by hand.

2. Protect improvements on adjoining properties and on Owner's property.

3. Protect boundary and property line markers, bench marks, and survey control points.

4. Restore damaged improvements and markers to their original condition, as acceptable to property owners.

PART 2 - PRODUCTS

A. Not applicable to this Section.

PART 3 - EXECUTION

3.1 SITE CLEARING

A. General:

1. Remove trees, shrubs, grass and other vegetation, improvements, or obstructions as required to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated.

B. Topsoil:

1. Topsoil is defined as friable clay loam surface soil found in a depth of not less than 6 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material.

2. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material.

   a. Remove heavy growths of grass from areas before stripping.

3. Stockpile topsoil in storage piles in areas as indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, as required, to prevent wind erosion, or seed and mulch if left undisturbed for a period of time greater than 14 consecutive days.

4. Legally dispose of off-site unsuitable soil, excess topsoil not to be stockpiled, and waste material debris.

5. Fill depressions caused by site clearing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

   a. Place fill material in horizontal layers not exceeding 8 inches loose depth, and thoroughly compact to a density equal to adjacent original ground, unless specific compaction is otherwise indicated in Section 31 2000 "Earth Moving", or, as directed in the geotechnical investigation.

3.2 DISPOSAL OF WASTE MATERIALS

A. Burning on Owner's Property: Burning will not be permitted on Owner's property.

B. Removal from Owner's Property: Remove waste materials, trash and debris, and legally dispose of same off site.

END OF SITE CLEARING

2. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Owner's Geotechnical Engineer.

C. "Additional Excavation": When excavation has reached required subgrade elevations, notify Owner's Geotechnical Engineer, who will make an inspection of conditions. If Owner's Geotechnical Engineer determines that bearing materials at required subgrade elevations are unsuitable, continued excavation may be required. If additional excavation is required, replace excavated material as directed by Owner's Geotechnical Engineer.

1. The Contract Sum will be adjusted by Change Order, or as provided in General Conditions, for additional excavation, measured in place (Bank Measure), and its replacement appropriately authorized in writing prior to beginning the work, and for which the Contractor is due payment from the Owner.

D. "Subgrade": The undisturbed earth or the compacted soil layer immediately below pavement base course, select drainage fill, bottom of indicated undercut areas, or topsoil materials.

E. "Structure": Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

F. "Building Control Area" and/or "Controlled Area": Below and at least 10-feet beyond building foot print or exterior walls, and below roofs, to include covered porches and canopies, and below and at least 5-feet beyond all walks and pavements subject to bearing vehicular traffic.

G. "Mud Footings" (if any): The at least 2-inches to 4-inches of lean 2,500 psi (minimum) concrete placed in the bottom of footing and foundation trenches and excavations, which is required if permanent or structural concrete cannot be placed the same day they are excavated.

1. Unless mud footings are indicated on Structural Drawings, their depth shall be compensated for by over-excavation.

2. Mud footings (if any) shall be completely clean prior to placement of any reinforcing and/or permanent or structural concrete.

3. Refer to the Owner's "Geotechnical Investigation" Report, and Structural Drawings for additional information and requirements for other "mud footings" (or "mud mats", or "mud seals").

H. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material exceeding 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu. yd. (0.57 cu. m) for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) wide, short-tip-radius rock bucket; rated at not less than 120-hp (89-kW) flywheel power with bucket-curling force of not

SECTION 31 2500

EROSION AND SEDIMENTATION CONTROL

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Temporary and permanent erosion control systems.

B. Slope Protection Systems.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary and Division 1 Specification Sections, apply to this Section.

1. Section 31 1000 - Site Clearing
2. Section 31 2000 – Earth Moving
3. The Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas, March 2022 edition or most recent edition.
4. Erosion and Sediment Control Plan

1.3 ENVIRONMENTAL REQUIREMENTS

A. The Contractor shall protect adjacent properties and water resources from erosion and sediment damage throughout the life of the contract.

1. The Contractor shall be responsible for the removal of sediments and debris escaping the project site, the remediation and/or repair of any damage that may occur as a result to adjoining and/or downstream affected properties or offsite structures and any fines or penalties levied against the project by regulatory agencies due to deficiencies of control measures.

B. Other than the land clearing activities required to install the appropriate erosion and sediment control measure in accordance with the erosion and sediment control plans, any down slope erosion and sediment control measures, on-site stream channel protection and upslope diversion of drainage required by site conditions, shall be in place and functional before any clearing or earth moving operations begin and shall be constructed and maintained throughout the construction period.

1. Temporary measures may be removed at the beginning of the workday but shall be replaced at the end of the workday.

C. The angle for graded slopes and fills shall be no greater than the angle which can be retained by vegetative cover or other adequate erosion control devices or structures. Any slope or fill which has been graded shall, within thirteen (13) days of the completion of such grading or the

completion of any phase of grading, be planted or otherwise be provided with ground cover, materials, devices, or structures sufficient to retain erosion. The devices, structures, and measures shall remain in place until the graded slope or fill is stabilized.

D. All hazardous substances used for this project shall be stored in accordance with current Spill Prevention Control and Countermeasures (SPCC) regulations.

1. Store substances away from storm drains, ditches, and gutters in water-tight containers.

2. Dispose of substances in accordance with ADEM regulations.

3. Provide adequate trash containers on-site for the disposal of material waste.

4. Prevent trash and debris from entering storm drainage system.

E. All construction materials shall be properly stored, not exposed to rain, and stockpiled. All containers shall be stored closed or under cover. All excess or waste material shall be disposed of properly.

1. Provide a construction waste dumpster or trailer on-site for disposal of construction waste.

2. Dispose of trash and waste to an acceptable offsite facility every week at a minimum.

3. Prevent trash and debris from entering storm drainage system.

F. There shall be no distinctly visible floating scum, oil, or other matter contained in the storm water discharge to a receiving water, must not cause an unnatural color (except dyes or other substances discharged for the purpose of environmental studies and which do not have a harmful effect on the receiving water) or odor in the receiving waters. The storm water discharge to receiving water must result in no material in concentration sufficient to be hazardous or otherwise detrimental to humans, livestock, wildlife, plant life, or fish and aquatic life in the receiving water.

1. Ensure all materials are handled appropriately.

2. No pollutants are allowed to be disposed of on-site or allowed to enter the storm drainage system.

G. Upon completion of the land disturbing activity and stable vegetation or other permanent controls have been established on all remaining exposed soil, the Contractor shall notify the Owner of this and request a final inspection.

1. The Owner, or his authorized agent, will inspect the site within 5 working days after receipt of notice.

H. The Contractor shall prevent the tracking of mud and debris onto paved roadways from construction areas.

1. Provide a construction exit pad in accordance with the erosion and sediment control plans and in accordance with the approved installation procedures, and maintain it on a daily basis.

    a. Provide a spray hose for the washing of tires and equipment

    b. Rework or supplement the construction exit pad stone as required to ensure its continued effectiveness throughout the duration of the construction period.

2. Remove any sediments tracked offsite or deposited on the adjacent roadways.

    a. Utilize a mechanically operated street sweeper to remove any mud and sediment deposited on the adjacent roadways.

I. The Contractor shall be responsible for keeping dust to a minimum through the use of water trucks or other dust controlling methods throughout the construction duration.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Quick growing grasses for temporary seeding (see seed mixes contained in CBMPP and in Plans).

B. Fencing for siltation control as specified on the plans.

C. Temporary mulches such as loose hay, straw, netting, wood cellulose or agricultural silage.

D. Fence stakes shall be metal stakes a minimum of 54 inches in length.

E. Stone check dams shall be spaced according to the Plans.

F. Stone Sediment Barriers or SiltSacks ™, or approved equal for inlet protection.

G. High Density Poly-Ethylene (HDPE) Filters or Silt-Saver™, or approved equal for inlet protection.

H. A stabilized construction entrance shall be constructed temporarily.

I. Riprap for slopes, culvert, storm drain inlet, and outlet aprons.

J. Water for dust control.

K. Wattle check dams shall be spaced according to plans.

L. Erosion control blankets and/or turf reinforcement mats to protect seed and prevent erosion on slopes.

PART 3 – EXECUTION

3.1 PREPARATION

A. Review site erosion and sediment control plan attached to this section of the specifications.

B. Deficiencies or changes in the erosion control plan as it is applied to current conditions will be brought to the attention of the Engineer for remedial action.

3.2 IMPLEMENTATION

A. Provide catalog cuts and information concerning the erosion control products which will be used for construction for review by the Engineer.

B. Provide information concerning the installation of the erosion and sedimentation control including anchorage trench provisions and anchorage devices and spacing for review by the Engineer.

C. Provide construction exit pad in accordance with the erosion and sediment control plan and in accordance with the approved installation procedures.

D. Place erosion control systems in accordance with the erosion and sediment control plan and in accordance with approved installation procedures.

E. The Engineer has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations. The Owner has the authority to direct the Contractor to provide immediate permanent or temporary pollution control measures. The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practical time to minimize the need for temporary controls. Cut slopes shall be permanently seeded and mulched as the excavation proceeds to the extent considered desirable and practical.

F. The temporary erosion control systems installed by the Contractor shall be maintained as directed by the Engineer to control siltation at all times during the life of the Contract. The Contractor must respond to any maintenance or additional work ordered by the Engineer within a 48 hour period.

G. Slopes that erode easily shall be temporarily seeded as the work progresses according to the ALDOT seeding schedule or according to the seeding schedule contained in the plans.

H. Remove and properly dispose of accumulated silt and sediment from all erosion control measures on a daily basis off site unless material is reusable.

I. Remove and properly dispose of all trash and sediments accumulated in existing and new storm drainage inlets, structures, and pipes on a daily basis off site unless material is reusable.

J. Provide temporary diversion berms and ditches as required during construction to protect work areas from up-slope runoff and/or to divert sediment-laden water to appropriate sediment control devices, traps, or stabilized outlets.

K. Provide water trucks or other adequate method for controlling dust throughout the construction period.

END OF EROSION & SEDIMENTATION CONTROL

SECTION 31 3116
TERMITE CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Soil-applied chemical treatment.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related work specified elsewhere includes:
   1. Section 03 3100 - Concrete.
   2. Section 31 2000 - Earth Moving.

1.03 DESCRIPTION OF WORK

A. Work described in this section includes soil treatment for termite control, for use and application below any new on-grade interior floor slabs, and also where any existing slabs may be opened or removed for any new, repair, replacement, or other subgrade work at interior of building and/or within interior perimeter exterior walls.

1.04 REFERENCE STANDARDS

A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; 2019.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.
   1. Include the EPA-Registered Label for termiticide products

C. Manufacturer's Instructions: Indicate caution requirement.

D. Qualification Data: For Installer of termite control products.

E. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following:
   1. Date and time of application.
   2. Moisture content of soil before application.
   3. Brand name and manufacturer of termiticide.
   4. Quantity of undiluted termiticide used.
   5. Dilutions, methods, volumes, and rates of application used.
   6. Areas of application.
   7. Water source for application.

F. Submit completed forms for required warranties, guarantees, and bonds for acceptance, prior to beginning work.

G. Executed warranty.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of type specified, with minimum 3 years of documented experience.

B. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work, including preparation of substrate and application.

C. Source Limitations: Obtain termite control products through one source and from a single manufacturer for each product.

D. Use only termiticides which bear a Federal registration number of the U.S. Environmental Protection Agency.
   1. Formulate and apply termiticides according to the EPA-Registered Label.

E. Mix treatment solution on site, in presence of Contractor's Superintendent, using clean potable water and new termiticide delivered to site in undamaged, original, unopened, and factory-sealed containers.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable code for requirements for application, application licensing, and authority to use toxicant chemicals, and comply with EPA regulations.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of toxicants where required.

1.08 SEQUENCING

A. Apply toxicant immediately prior to installation of vapor barrier under slabs-on-grade.

1.09 JOB CONDITIONS

A. Restrictions: Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.

B. Environmental Limitations: To insure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year installer's warranty against damage to building caused by termites.
   1. Provide paid-up and bonded guarantee for a period of five (5) years from date of treatment, signed by the Applicator and Contractor. Paid-up guarantee shall include annual inspection during the five (5) years and an agreement to renew the bond annually after the five (5) years is up, on payment by the Owner of an annual fee.
   2. Inspect annually and report in writing to Owner. Provide inspection service for 5 years from Date of Substantial Completion.
   3. A specimen of the form of guarantee and the bond shall be submitted for approval before the work begins.

C. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work consisting of applied soil termiticide treatment will prevent infestation of subterranean termites, including Formosan termites (Coptotermes formosanus). If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
   1. Warranty Period: Five years from date of Substantial Completion.

D. Wood Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work consisting of applied wood termiticide treatment will prevent infestation of subterranean termites, including Formosan termites (Coptotermes formosanus). If subterranean termite damage is discovered during warranty period, repair or replace damage caused by termite infestation and treat replacement wood.
   1. Warranty Period: 12 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 CHEMICAL SOIL TREATMENT

A. Toxicant Chemical: EPA Title 7, United States Code, 136 through 136y approved; synthetically color dyed to permit visual identification of treated soil.

B. Manufacturers/Products: Subject to compliance with requirements, provide one of the following termiticide products:
   1. Aventis Environmental Science USA LP; Product "Termidor".

2. Bayer Environmental Science Corp; Product "Premise 75, Premise Pre-Construction, or Premise Pro": www.nobugs.com.
3. Nisus; Product "Bora-Care": www.nisuscorp.com.
4. Syngenta Professional Products: www.syngentaprofessionalproducts.com.

C. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

D. Diluent: Recommended by toxicant manufacturer.
1. Fuel oil will not be permitted as a dilutent.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that soil surfaces are unfrozen and dry to absorb toxicant, ready to receive treatment.

B. Verify final grading is complete; see Section 31 2200.

C. Verify utility trenches are wide enough to receive application.

D. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.
1. Proceed with application only after unsatisfactory conditions have been corrected.

3.02 PREPARATION:

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.03 APPLICATION - CHEMICAL TREATMENT

A. Comply with requirements of U.S. EPA and applicable state and local codes.
1. Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

B. Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

C. Spray apply toxicant in accordance with manufacturer's instructions.

D. Apply toxicant at following locations:
1. Under Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment.
a. Under slab-on-grade structures, treat soil before concrete footings and slabs are placed, using the following rates of application (unless manufacturer recommends otherwise):

1) Apply four (4) gallons of chemical solution per ten (10) linear feet to soil in critical areas under slab, including entire inside perimeter inside of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers.
2) Apply one (1) gallon of chemical solution per ten (10) square feet as an overall treatment under slab and attached slab areas where fill is soil or unwashed gravel. Apply 1-1/2 gallons of chemical solution to areas where fill is washed gravel or other coarse absorbent material.
3) Apply four (4) gallons of chemical solution per ten (10) linear feet of trench, for each foot of depth from grade to footing, along outside edge of building. Dig a trench six (6) inches to eight (8) inches wide along outside of foundation to a depth of not less than twelve (12) inches. Punch holes to top of footing on not more than twelve (12) inches on center and apply chemical solution. Mix chemical solution with the soil as it is being replaced in trench

2. In Crawl Spaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
   a. In crawl-space and basement structures, treat soil along exterior and interior walls of foundations with shallow footings as specified above for exterior of slab-on-grade structures. Treat soil under or around crawl-space structures using the following rates of application (unless manufacturer recommends otherwise):
      1) Apply four (4) gallons of chemical solution per ten (10) linear feet of trench along inside of foundation walls, along both sides of interior partitions, and around piers and plumbing. Do not apply an overall treatment in crawl spaces.
      2) Apply four (4) gallons of chemical solution per ten (10) linear feet of trench, for each foot of depth from grade to footing, along outside of foundation walls.
      3) Apply one (1) gallon per ten (10) square feet of soil surface as an overall treatment, where attached concrete structures are on fill or ground.
3. Foundations: At Both Sides of Foundation Surface: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
4. At hollow masonry foundations or grade beams:
   a. Treat voids at rate of two (2) gallons per ten (10) linear feet (unless manufacturer recommends otherwise), poured directly into the hollow spaces.
5. Masonry: Treat voids.
6. At expansion joints, control joints, and areas where slabs will be penetrated:
   a. Apply at rate of four (4) gallons per ten (10) linear feet of penetration (unless manufacturer recommends otherwise).
7. Soil Within 10 feet (3 m) of Building Perimeter For a Depth of 1 foot .

E. Under slabs, apply toxicant immediately prior to installation of vapor barrier.

F. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.

G. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.

H. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

I. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

J. Re-treat disturbed treated soil with same toxicant as original treatment.
   1. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

K. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

L. Post signs in areas of application warning workers that soil termiticide treatment has been applied. Remove signs when areas are covered by other construction.

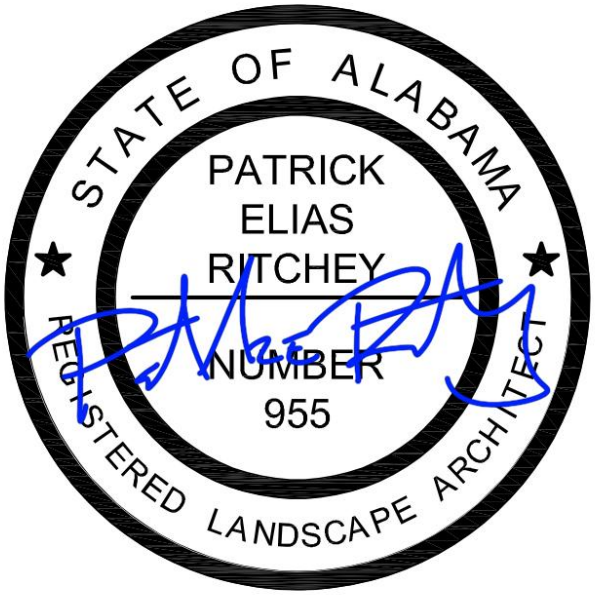
3.04 PROTECTION

A. Do not permit soil grading over treated work.

B. Protect applications from damage after completion. Repair disturbances according to manufacturer's written instructions.

END OF SECTION

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STATE OF ALABAMA
PATRICK
ELIAS
RITCHEY
NUMBER
955
REGISTERED LANDSCAPE ARCHITECT

SECTION 32 1216

ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to this Section.

B. Related work described elsewhere includes:

.. Section 31 2000 - "Earth Moving"
.. Section 32 1313 - "Concrete Paving"
.. Section 32 1613 - "Curbs and Gutters"

1.2 DESCRIPTION OF WORK

A. Work described in this section includes new bituminous paving, a new base, and otherwise as indicated on drawings.

B. Work shall also include pavement patching for any utility trenches under existing paving and this Contract, with prepared subgrade, 8" crushed aggregate base, 6 inch thick 3,000 psi concrete, prime coat, and 1-1/2 inches bituminous concrete overlay, and as indicated on the Drawings.

1. Pavement patch shall extend 9" to 1'-0" beyond each side or edge of trench, and to abut flush with edge where existing paving was cut out.

1.3 QUALITY CONTROL

A. Certifications: The Contractor shall submit to the Architect copies of certificates from suppliers of bituminous materials and other manufactured items, certifying that these products comply with specifications and standards listed hereinafter.

1. All asphalt used for pavement shall be produced by a plant certified by the Alabama Department of Transportation (ALDOT).

B. Standard Specifications: Unless otherwise noted, all specifications referred to shall be the "Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction", latest edition.

C. Testing: All laboratory and field testing required to ensure compliance with these specifications will be performed by an independent testing laboratory. Refer to Section 01 0150 - "Special Conditions," for additional information.

1.4 JOB CONDITIONS

A. Any base or sub-base areas damaged by weather or construction operations shall be scarified, remixed and recompacted in accordance with requirements before application of the prime coat.

B. Special care and attention shall be given to be certain that paving operations and/or equipment do not cause damage to any existing and/or new buildings, structures, or improvements which are to remain.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide the paving system(s) indicated on the Drawings, installed in accordance with Part 3 of this Section, and referenced standards.

PART 3 - EXECUTION

3.1 PRIME COAT

A. Application rates and construction requirements shall be as specified in ALDOT Section 401, Bituminous Surface Treatments, for a Bituminous Treatment Type "A" which is a prime coat.

3.2 TACK COAT

A. Construction requirements, including preparation of the existing surface or substrate and maximum application rates, are specified in ALDOT Article 405.03.

3.3 PLANT MIX BITUMINOUS CONCRETE BINDER LAYER AND BITUMINOUS CONCRETE WEARING SURFACE

A. Construction requirements, including finished surface tolerance, density requirements, and maintenance and protection shall be as specified in ALDOT Articles 410.03 through 410.07, 327.03 and 424.04, as applicable. Rate of application shall be not less than the number of pounds per square yard for a 1-inch wearing surface or pavement patching layer, pro-rated for other thicknesses, as required by referenced ALDOT Specifications.

3.4 CRUSHED AGGREGATE BASE

A. Construction requirements shall comply with the ALDOT Specifications for the materials indicated, including in part, applicable portions of Section 825, Type B and ALDOT Section 301; compacted in accordance with the recommendations made in the geotechnical investigation.

3.5 COMPACTION EQUIPMENT

A. Compaction equipment shall be self-propelled, capable of compacting the mixture throughout the depth of the layer while it is still in a workable condition without damage to the material.

1. Self-propelled rollers shall have a minimum weight of 10 tons.

3.6 PAVEMENT PATCH

A. Saw cut perimeter of existing paving to a neat straight line where removal is indicated and/or required.

1. Protect edges of paving and base exposed to prevent cracking, breaking-up, wash-out, erosion, and/or other damage; apply prime coat as specified and at all such vertical edges prior to placing new pavement.

B. Patch pavement with components stated in Paragraph 1.2-B above, in compliance with each component's specified requirements, and as per details and sections on Drawings, if any.

END OF ASPHALT PAVING

SECTION 32 1313

CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related work specified elsewhere includes:

.. Section 31 2000 - "Earth Moving"
.. Section 03 3100 - "Concrete"
.. Section 07 9000 - "Joint Sealers"

1.2 DESCRIPTION OF WORK:

A. Extent of portland cement concrete paving is shown on drawings, including exterior walks, paving, entry pads, dumpster pads, and mechanical equipment pads.

1.3 QUALITY ASSURANCE:

A. Codes and Standards: Comply with "Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction," latest edition, and local governing regulations if more stringent than herein specified.

B. Testing: All laboratory and field testing required to ensure compliance with these specifications will be performed by a qualified independent testing laboratory. Refer to Section 01 0150 - "Special Conditions", for additional information and requirements.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Forms:

1. Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

2. Use flexible spring steel forms or laminated boards to form radius bends as required.

3. Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.

B. Welded Wire Mesh:

1. Welded plain cold-drawn steel wire fabric, ASTM A 185.

a. Size: 6” x 6” #6, unless indicated otherwise.

2. Furnish in flat sheets, not rolls, unless otherwise acceptable to Engineer, for all concrete paving subject to possibility of bearing the weight of vehicular traffic.

3. Furnish in rolls for all concrete paving accessible only to pedestrian traffic, unless indicated otherwise on structural drawings.

4. Locations for Use: All concrete pads and paving, at 1/3 of total depth of concrete from top of slab.

C. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 40 or 60.

D. Concrete Materials: Comply with requirements of Section 03 3100 - “Concrete”, for concrete materials, admixtures, bonding materials, and other materials as required.

E. Expansion Joint Materials: Comply with requirements of Section 07 9000 - “Joint Sealers” for preformed and pourable expansion joint fillers and sealers.

F. Curing and Sealing Compound: Conform to TT-C-800, with 30% solids content minimum.

2.2 CONCRETE MIX, DESIGN AND TESTING:

A. Comply with requirements of Section 03 3100 - “Concrete”, for concrete mix design, sampling and testing, and quality control, and as herein specified.

B. Design mix to produce normal-weight concrete consisting of portland cement, aggregate, water-reducing or high-range water-reducing admixture (super-plasticizer), air-entraining admixture and water to produce the following properties:

1. Sidewalks, curbs and gutters, entry pads, and mechanical equipment pads subject only to pedestrian traffic:

a. Compressive Strength: 3,000 psi, minimum at 28 days.
b. Maximum Slump: 3"
c. Air Content: 2.5% to 6%
d. Thickness: 6", unless indicated otherwise.
e. Compacted Subgrade: 6" crushed aggregate base on compacted subgrade (98% S.P.D.).

2. Paving and pads subject to vehicular traffic, valley gutters, dumpster pads, and where indicated:

a. Compressive Strength: 4,000 psi, minimum at 28 days (minimum 550 psi flexural strength) in accordance with ALDOT Section 450 – "Portland Cement Concrete

Pavement", of the Alabama Department of Transportation, Standard Specifications for Highway Construction, most current edition.

b. Maximum Slump: 3.5”
c. Air Content: 2.5% to 6%
d. Thickness: 6", unless greater thickness is indicated on the Drawings.
e. Subgrade: Unless otherwise indicated on the Drawings, 6" dense graded aggregate base, ALDOT Section 825, Type B (98% M.P.D.), installed in accordance with construction requirements for the materials indicated, including in part, applicable portions of Section 825 and Section 301.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION:

A. Remove loose material from compacted subbase surface immediately before placing concrete.

B. Proof-roll prepared subbase surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

C. Subgrade shall be approved by the Owner's Geotechnical Engineer before paving begins.

3.2 FORM CONSTRUCTION:

A. Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork for grade and alignment to following tolerances:

1. Top of forms not more than 1/8" in 10'.

2. Vertical face on longitudinal axis, not more than 1/4" in 10'.

C. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

3.3 REINFORCEMENT:

A. Locate, place and support reinforcement as specified in Section 03 3100 – “Concrete”, unless otherwise indicated. Install welded wire fabric in as long lengths as practicable, lapping at least on mesh.

3.4 CONCRETE PLACEMENT:

A. Comply with requirements of Section 03 3100 - “Concrete”, for mixing and placing concrete, and as herein specified.

B. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase, if required, to provide a uniform dampened condition at time concrete is placed. Do not

place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with core to prevent dislocation of reinforcing, dowels, and joint devices.

1. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2-hour, place a construction joint.

3.5 JOINTS:

A. General: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

B. Weakened-Plane (Contraction) Joints:

1. Provide weakened-plane (contraction) joints, sectioning concrete into areas as shown on drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness, as follows below.

2. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.

3. Sidewalks shall be scored at 5-foot intervals unless otherwise indicated.

C. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for a period of more than 1/2-hour, except where such placements terminate at expansion joints.

D. Expansion Joints:

1. Provide expansion joints with premolded joint filler at locations abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.

2. Extend joint fillers full-width and depth of joint.

3. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together.

4. Expansion joints for sidewalks shall be placed at 30-foot maximum intervals and along all intersections with other walks, steps, curbs, or other vertical surfaces.

E. Fillers and Sealants: Comply with the requirements of Section 07 9000 - “Joint Sealers”, for preparation of joints, materials, installation and performance.

3.6 CONCRETE FINISHING:

A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Using hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

C. Work edges of slabs and formed joints with an edging tool, and round to 1/4" radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

D. After completion of floating and troweling, when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

1. Light and smooth broom finish, by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation as required to provide a fine line texture acceptable to Architect.

E. On inclined slab surfaces, provide a coarse, non-slip finish by scoring surface with a stiff-bristled broom, perpendicular to line of traffic.

F. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Architect.

1. Provide rubbed finish for exposed edges of concrete work, and apply light and smooth broom finish.

3.7 CURING:

A. Protect and cure finished concrete paving, complying with applicable requirements of Section 03 3100 - “Concrete”. Use curing and sealing compound or approved moist-curing methods.

B. Begin initial curing as soon as free water has disappeared from exposed surfaces. Where possible, keep continuously moist for not less than 72 hours. Continue curing by use of moisture-retaining cover or membrane-forming curing compound. Cure formed surfaces by moist curing until forms are removed. Provide protections as required to prevent damage to exposed concrete surfaces.

3.8 REPAIRS AND PROTECTIONS:

A. Repair or replace broken or defective concrete, as directed by Architect.

B. Drill test cores where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy resign grout.

C. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

1. Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

END OF CONCRETE PAVING

SECTION 32 1613

CURBS AND GUTTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division I Specification Sections, apply to this section.

B. Related work specified elsewhere includes:

.. Section 31 2000 - "Earth Moving"
.. Section 32 1313 - "Concrete Paving"
.. Section 03 3100 - "Concrete"
.. Section 07 9000 - "Joint Sealers"

1.2 DESCRIPTION OF WORK

A. Work described in this section includes the construction of new concrete curbs and gutters, and/or straight curbs where indicated, and patching between any existing paving and new curb and gutters, sidewalks, etc., to match existing pavement.

B. Refer to Drawings and Owner's Report of Geotechnical Exploration, for additional information and base requirements.

C. Refer to Section 31 2000 - "Earth Moving" for subgrade requirements below and beyond curbs and gutters.

D. Refer to Section 32 1313 - "Concrete Paving", for valley gutters, turn-outs, and paving.

1.3 QUALITY CONTROL

A. Certifications: The Contractor shall submit to the Architect copies of certificates from suppliers of ready-mix concrete, reinforcing steel, curing material, joint fillers, and other manufactured items, certifying that these products comply with the specifications and standards listed hereinafter.

B. Standard Specifications: Unless otherwise noted, all specifications referred to shall be the Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction, latest edition.

C. Testing: All laboratory and field testing as required to ensure compliance with these specifications shall be performed by a qualified independent testing laboratory. Refer to Section 01 0150 - "Special Conditions", for additional information.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Concrete shall be Class "A", Type 4 (3,000 psi), in accordance with Section 501, "Structural Portland Cement Concrete", of the Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction, latest edition. A modified mix shall be used if optional machine laid curb and gutter is constructed.

B. Reinforcing steel, where called for on the drawings, shall meet the requirements of Section 502, "Steel Reinforcement".

C. Curing material shall be either burlap cloth, waterproof paper, polyethylene sheeting, or impervious membrane specified in ALDOT Articles 830.01 and 830.02.

D. Joint filler and sealer for expansion and construction joints shall meet the appropriate requirements of ALDOT Section 832, and Section 07900 - "Joint Sealers" herein.

E. Asphalt for repairs shall comply with referenced ALDOT Specifications, and city requirements, and shall match existing pavement at location(s) requiring patching.

PART 3 - EXECUTION

3.1 CURBS AND GUTTERS

A. Comply with requirements of Section 32 1313 - "Concrete Paving," Section 03 3100 - "Concrete," and the following:

1. Construction requirements, including foundation, forms, sections, joints, placing and finishing concrete, curing and protection, and backfilling shall be as specified in Article 623.03. Curbs and gutters shall match the profile of existing adjoining curb and gutter, if any, and otherwise as detailed.

2. Curb and gutter shall be constructed in sections having a maximum length of 10-feet. Transverse expansion joints with filler and joint sealer shall be installed at all curb returns and in curb and gutter at intervals not exceeding 40-feet. Similar joints shall be installed behind the curb where sidewalks adjoin the curb and gutter, and at all fixed objects which adjoin or extend through the curb and gutter.

3. Care shall be exercised that "tilt-out" curb and gutter is installed where pavement slopes away from the curb, and that 10-foot long transition sections are used where required to transition between "standard" and "tilt-out" curb and gutter.

3.2 REPAIRS AND PROTECTIONS

A. Repair or replace broken or defective concrete, as directed by Architect.

B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14-days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

1. Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

END OF CONCRETE CURBS AND GUTTERS

SECTION 32 1723

PAVEMENT MARKING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work described in this section includes marking of graphic symbols, lane separations, parking stripes, and lettering on concrete and asphalt pavements, if any, at locations indicated and as shown on the Drawings.
B. Related work specified elsewhere includes:
.. Section 32 1216 - "Asphalt Paving"
.. Section 32 1313 - "Concrete Paving"

1.2 QUALITY CONTROL

A. Certifications: The Contractor shall submit to the Architect copies of certificates from suppliers of materials, certifying that these products comply with specifications and standards listed hereinafter.
B. Standard Specifications: Unless otherwise noted, all specifications referred to shall be Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction, most current edition.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Paint for pavement marking shall be, traffic marking paint complying with Section 856, of the ALDOT specifications, and as follows:

1. Class 1, Type A (reflective) in public Right-of-Ways.
2. Class 1, Type B (non-reflective) within property lines of this project's site, 2 coats.

PART 3 - EXECUTION

3.1 PAVEMENT MARKING:

A. Each individual painted parking stripe shall be 4-inches wide, and shall be laid out as indicated on the drawings. Construction requirements shall conform to the applicable parts of Article 701.03 of the ALDOT Specifications for Class 1, Type as specified, traffic stripe.

1. Color shall be white for asphalt, yellow for concrete pavement, and international blue for striping and graphics for parking spaces for people with disabilities.
2. Use same materials and construction methods for any arrows and symbols indicated on paved areas.
3. Mark paving at each space for the people with disabilities with acceptable international graphics symbol, unless otherwise indicated, approximately 4' x 4' in

size. Locate centered in space width and approximately 2'-0" from end of space where vehicle enters.

END OF PAVEMENT MARKING

SECTION 32 3300
SITE FURNISHINGS

PART 1- GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and General provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections apply to the work of this Section.

B. Sections 02751 – "Portland Cement Concrete Paving".

C. Section 03310 – "Concrete".

1.02 DESCRIPTION OF WORK:

A. This Section includes the following:
   a. Trash Receptacles.
   b. Picnic Tables
   c. Wood Bench

B. The extent of site is indicated of the drawings.

1.03 SUBMITTALS:

A. Submit the following:

1. Manufacturer's specifications and product data for each type of site and street furnishing.

2. Shop Drawings and Installation Drawings: Submit for each type of site furnishing.

3. Where color and finish variations are available, submit finished physical samples of materials for review and selection.

4. Warranty: Submit warranty for fixture made out in Owner's name.

1.04 Warranty:

A. Provide manufacturer's advertised warranty on furnishings.

PART 2- PRODUCTS

2.01 GENERAL:

A. Furnish and install site furnishings in the quantities indicated.

2.02 TRASH RECEPTACLE:

A. Litter Receptacle, 30 gallon capacity, with polyethylene liner.

B. Receptacle formed of 11-gauge steel.

C. Finish: Powdercoat, in color selected by Architect from manufacturer's full range of colors.

D. Product/Manufacturer:
   a. Petoskey, with hinged lid style, as manufactured by LandscapeForms: www.landscapeforms.com
   b. For substitutions: See Section 01600 – Product Requirments.

2.03 PICNIC TABLE WITH BENCHES:

A. Picnic table with benches attached, 6 feet long. Bolted to concrete patio slab.

B. Product/Manufacturer:
   a. Larchmont Picnic Table #4859 Picnic Table, 6' long: www.countrycasual.com
   b. For substitutions: See Section 01600 - Product Requirements.

2.04 WOOD BENCH:

A. Surface mounted wood bench, 6 feet long. Bolted/attached to concrete patio slab.

B. Product/Manufacturer:
   a. Wellspring Collection, 72 inch bench, 17.5" seat height, 25"D x 34"H x 72"L, as manufactured by LandscapeForms: www.landscapeforms.com.
   c. For substitutions: See Section 01600 - Product Requirements.

PART 3-EXECUTION

3.01 SYSTEM DESIGN:

A. Install at locations indicated and only with prior confirmation by the Architect, in strict accordance with manufacturer's current written instructions and recommendations.

B. Provide and install all necessary anchors and fasteners. Where requested, paint bolt heads to match surrounding finish or in another color, as selected by Architect.

B. Coordinate installation and fitting with the work of other trades.

3.02 INSTALLATION:

A. Install in accordance with manufacturer's recommendations.

3.03 CLEANING AND PROTECTION:

A. Clean furnishings of all foreign matter and touch-up marred finishes in accordance with manufacturer's current written recommendations.

B. Clean Repair any items damaged prior to Substantial Completion and/or as a result of the work of this Contract, subject to Architect's and Owner's acceptance, or replace.

END OF SECTION 32 3300

SECTION 32 8420
UNDERGROUND IRRIGATION
(PERFORMANCE SPECIFICATION)

PART 1- GENERAL

1.01 SUMMARY:

A. Work Included: Provide an underground sprinkler system based on these specifications and as required for complete coverage of designated landscaped areas. Work includes, but is not limited to:
   1. Landscape sprinkler system.
   2. Automatic controller, remote valves and wiring.
   3. Responsibility for full and complete coverage of all designated irrigated areas denoted on plan sheet L7.00, including necessary adjustments during installation, maintenance and guarantee periods at no additional cost.
   4. Specified maintenance and guarantee period.

1.02 RELATED WORK:

A. Landscape Work- Section 32 9000.

1.03 QUALITY ASSURANCE:

A. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with the latest rules of the National Electric Code for all electrical work and materials.

B. Manufacturer Qualifications: Provide underground sprinkler system as complete unit produced by a single acceptable manufacturer, including heads, valves, piping circuits, controls, and accessories.

1.04 SUBMITTALS:

A. Submit the following:
   1. Project Record Drawings: Provide separate and complete Project Record Drawings prepared in accordance with the provisions of Division 1 Series of these Specifications.

1.05 JOB CONDITIONS:

A. Utilities: Determine location of underground utilities and perform work in a manner which will avoid all possible damage. Hand excavate, as required. Repair damage to utility owner's satisfaction at no additional cost.

PART 2- PRODUCTS

2.01 MATERIALS:

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. Rain Bird Sprinkler Mfg. Corp.
2. Hunter Industries Incorporated.

B. Pipe: PVC plastic pipe, ASTM D-1785, Schedule 40, for sleeves, mainline, and pipe under paving; PVC plastic pipe D-2241, SDR/PR 200 elsewhere.

C. Pipe Fittings: For PVC plastic pipe, ASTM D-2466 socket fittings with ASTM D-2564 solvent cement.

D. Valves: Manufacturer's standard, of type and size indicated, and as follows. Provide cast bronze bodies, unless otherwise indicated.
1. Manual Station Valves: Globe valves.
2. Key Operated Valves: Manual valves, fitted for key operation. Furnish 3 valve keys.
3. Automatic Circuit Valves: Globe valves operated by low-power solenoid, normally open manual flow adjustment.
4. Automatic Drain Valves: Designed to open for drainage when line pressure drops below 3 psi.

E. Backflow Preventer: Watts No. 709 Series Backflow Preventer or approved equal.

F. Water Meter: Provide separate water meter, if required, for irrigation system sized as per manufacturer's recommendation.

G. Sprinkler Heads: Manufacturer's standard unit designed to provide uniform coverage over entire area of spray at available water pressure, as follows:
1. Flush Surface: Fixed pattern, with screw-type flow adjustment.
2. Pop-Up Spray: Fixed pattern, with screw-type flow adjustment and stainless steel retraction spring.
3. Shrubbery: Fixed pattern, with screw-type flow adjustment.
4. Pop-Up Rotary Spray: Gear drive, full circle and adjustable part circle type.

H. Valve Box: Precast by Ametek, or approved equal.

I. Valve Cover and Frame: By Ametek, with provision for locking.

2.02 AUTOMATIC CONTROL SYSTEM:

A. General: Provide low voltage system manufactured expressly for control of automatic circuit valves of underground sprinkler systems. Provide unit of capacity to suit number of stations as indicated.

B. Exterior Control Enclosure: Manufacturer's standard weatherproof enclosure with locking cover, complying with NFPA 70 (National Electric Code).

C. Transformer: To convert building service voltage to control voltage of 24 volts.

D. Station Control: Each station variable from approximately 5 to 60 minute. Include switch for manual or automatic operation of each circuit.

E. Timing Device: Adjustable, 24-hour and 7 or 14 day clocks to operate any time of day and skip any day in a 7 or 14 day period. Allow for manual or semi-automatic operation without disturbing preset automatic operation.

PART 3-EXECUTION

3.01 SYSTEM DESIGN:

A. Design Pressures: Follow manufacturer's performance recommendations for specific head type and intended coverage.

B. Location of Heads: Lay out heads to achieve complete and uninterrupted coverage and minimize water wasted by overthrow on pavement.

3.02 TRENCHING AND BACKFILLING:

A. General: Excavate straight and true with bottom uniformly sloped to low points. Protect existing or previously installed lawns and plantings. Remove and replant as necessary to complete installation. Replace damaged plants with new to match existing.

B. Trench Depth: Excavate trenches to a depth of 3" below invert of pipe, unless otherwise indicated.

C. Minimum Cover: Provide 12" minimum cover over top of installed main line piping, 12" minimum cover over lateral lines, or meet local requirements for minimum cover, whichever is greater.

D. Backfill: Backfill with clean material from excavation. Remove organic material as well as rocks and debris larger than 1" diameter. Place acceptable backfill material in 6" layers, compacting each layer.

E. Pavements: Where existing pavements must be cut to install landscape irrigation system, cut smoothly to straight lines 6" wider than trench. Wherever possible, bore under paved areas. Excavate trench to required depth and width. Trench depth shall be a minimum equal to depth of pavement and base, and of sufficient depth to meet minimum coverage requirements. Remove cut-out pavement and excavated material from the site. Replace pavement cuts with equal materials and finishes.

F. Sleeving: Provide schedule 40 PVC Sleeving for all piping under new paving.

3.03 INSTALLATION:

A. General: Comply with requirements of the Standard Plumbing Code and all local codes and ordinances.

B. Connection to Main: Determine main line location. Connect to existing main line in such a manner as to reduce wasted pipe. Install new valve and union.

C. Maintain uninterrupted water service to building during normal working hours. Coordinate temporary water shut-off with Owner.

D. Backflow Preventer: Provide union on downstream side of main line. Assembly shall be housed in an above ground, waterproof housing. This housing shall be accessible for periodic testing purposes. Irrigation Contractor is to consult local codes and authorities to assure proper installation of the assembly.

E. Station Valves: Install in valve box, arrange for easy adjustment and removal. Provide union on downstream side. Adjust automatic control valves to provide flow rate of rated operating pressure required for sprinkler circuit.

F. Piping:
1. Lay pipe on solid subbase, uniformly sloped without humps or depressions.
2. At wall penetrations, fill the opening around pipe with non-shrink grout. At exterior face, leave a perimeter slot approximately 1/2" wide by 3/4" deep. Fill this slot with backer rod and an acceptable elastomeric sealant. Repair below grade waterproofing disturbed by this work and make penetration watertight.
3. Install PVC pipe in dry weather when temperature is above 40 degrees F. in strict accordance with manufacturer's instructions. Allow joints to cure at least 24 hours at temperatures above 40 degrees F. before testing, unless recommended by manufacturer.

G. Sprinkler Heads: Flush station lines with full head of water and install heads after hydrostatic test is completed.
1. Locate part-circle heads to maintain a minimum distance of 4" from walls and 2" from other boundaries, unless otherwise indicated.

H. Dielectric Protection: Use dielectric fittings at connection where pipes of dissimilar metal are jointed.

3.04 TESTING:

A. General: Notify Architect in writing when testing will be conducted. Conduct tests in presence of Architect.

B. Hydrostatic Test: Test water piping and valves, before backfilling trenches, to hydrostatic pressure of not less than 100 psi. Piping may be tested in sections to expedite work. Remove and repair or replace piping, connections, valves which do not pass hydrostatic testing.

C. Operational Testing: Perform operational testing after hydrostatic testing is completed, backfill is in place, and sprinkler heads adjusted to final position. Demonstrate to Architect that system meets coverage requirements and that automatic controls function properly. Coverage requirements are based on operation of one circuit at a time.

D. After completion of grading and planting, carefully adjust sprinkler head locations and heights so they will furnish complete coverage.

3.05 CODES AND ORDINANCES

A. All material and operations shall conform to tall applicable codes and ordinances. It is the Contractor's responsibility to investigate and follow all regulations.

3.06 PERMITS AND FEES

A. The Contractor shall obtain, at his expense, all required permits and shall pay all required fees, including impact fees from local governments that may apply. Any penalties imposed due to failure to obtain any permit or pay any fee shall be the responsibility of the Contractor.

3.07 WARRANTY AND GUARANTEE

A. The Contractor shall furnish a certificate of warranty registration and a written guarantee of work and materials for a one year period from the date of final acceptance of the Irrigation System by the Owner and the Designer.

END OF SECTION 32 8420

SECTION 32 9000
LANDSCAPE WORK

SECTION 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary and General Requirements apply to the work specified herein.
B. Irrigation Performance - Section 32 8420.
C. Landscape Maintenance - Section 32 9700.

1.2 DESCRIPTION:

A. Provide all labor, equipment, materials and services necessary to complete the Work of this Section, including:

1. Providing, placing, grading topsoil and/or sand for landscape grading as indicated in the Drawings.
2. Providing and installing trees, shrubs, ground covers, and solid sod for landscape planting.
3. Maintenance for thirty days after Substantial Completion, and Two (2) Year Guarantee Period.

1.3 SUBMITTALS:

A. Qualification Data for firms specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include a list of a minimum of five (5) similar projects completed with the last five (5) years with project name, address, names of Architects and Owners, overall description of scope of work, and contract value.

B. Materials Lists:

1. Within ten (10) days of award of Contract, submit a complete list of materials and unit prices demonstrating source, availability, and complete conformance with requirements specified.

2. Substitutions not permitted unless proof is submitted to the Landscape Architect's satisfaction that the material is unavailable as specified.

C. Certificates: Deliver all certificates of inspection to the Engineer.

D. Product Data:

1. Submit manufacturer's product literature, instructions and guaranteed analysis for fertilizer.

1.4 DEFINITIONS:

A. Trees, shrubs, groundcovers, and sod are plant materials listed in Plant Schedule on Drawings.

1.5 JOB CONDITIONS:

A. Coordinate the Work of this Section with that of other trades.

B. Examine conditions under which Work is to be performed and notify Landscape Architect and Landscape Architect in writing of unsatisfactory conditions.

C. Do not perform Work until conditions are satisfactory and acceptable.

D. Notify utility companies, prior to digging, for locations of underground utilities (electrical power, telephone, cable, water, sewer and gas) and perform Work in a manner which will avoid all possible damage. Hand excavate as required.

E. Maintain stakes or other location markers and controls set by others until removal is mutually agreed upon by all parties.

1.6 QUALITY ASSURANCE:

A. Codes and Standards:

1. Applicable Sections of Alabama Highway Department (ALDOT) Standard Specifications for Highway Construction, 2001 Edition as amended.

2. All plant materials to comply with State and Federal laws relating to inspection for disease and insect control.

3. Plant material quality to conform to *American Standard for Nursery Stock*, American Association of Nurserymen, Inc., 1986, ANSI Z-60.1.1

4. Plant Material nomenclature to conform to:

a. *Hortus Third*, a Concise Dictionary of Plants Cultivated in the United States and Canada, MacMillan Publishing Company, Inc., New York, 1976 Edition.

b. Names not listed in the above standard to comply with those most commonly used in the trade.

c. In all cases, botanical names take precedence over common names.

B. Installer Qualifications: Firm shall hold Alabama General Contractor's License for Classification S - Specialty Construction, Subclassification 4 - Landscaping. Firm experienced in the successful installation of a minimum of five (5) projects within the past five (5) years similar in scope, quality, and contract value to that indicated for this project. Firm shall have sufficient manpower, equipment and financial resources to complete the Work of this Section.

C. Personnel: Use adequate numbers of skilled workmen trained and experienced in the Work and familiar with requirements and methods needed for performance of the Work. At all times during planting operations, have on the site a person knowledgeable in horticultural practices as a superintendent.

D. Inspection and Approval:

1. All plant material is subject to inspection and approval in the field or nursery before digging, by the Landscape Architect.

2. All plant materials and other materials are subject to inspection and/or rejection at the site before planting or placing, or at any other time.

3. Attach secure, durable, legible waterproof labels, stating correct botanical and common names as specified, to a least one (1) plant, bundle or container of each plant variety.

4. Remove from site plant materials or other materials not complying with specified requirements within 5 days of rejection.

5. Approval is for visual qualities only and does not relieve the Contractor of his obligation to provide materials and workmanship in full compliance with the requirements of the Contract Documents.

1.7 PRODUCT DELIVERY, STORAGE and HANDLING:

A. Deliver packaged materials in manufacturer's original containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery, and while stored at the site.

B. Deliver all non-packaged or non-containerized materials to site in a manner that will prevent loss, damage, deterioration or contamination.

C. Store all materials in approved locations to prevent loss, damage, deterioration or contamination.

D. Deliver, storage and handling of all plant materials shall conform to ALDOT Specification Section 860.06(c) and the following:

1. Deliver freshly dug plants, which have not been in cold storage or heeled-in.

2. Do not prune prior to delivery.

3. Do not bend or bind trees or shrubs in such a manner as to damage bark, break branches or destroy natural shape.

4. Provide necessary protective covering during transport and delivery.

5. Deliver plants after preparations for planting have been completed and approved, and plant immediately.

1.8 SITE MAINTENANCE:

A. Keep roads, paving and structures adjacent to maintenance operations clean and free of obstructions, mud and debris at all times.

B. Do not permit flushing of roads or disposal of dirt or debris into sewers or drainage ditches.

C. Control dust from maintenance operations.

SECTION 2 - PRODUCTS

2.1 SOIL MATERIALS:

A. Topsoil:

1. This Contractor shall furnish topsoil in sufficient quantity, to complete grading and planting operations as specified.

2. Characteristics of topsoil to be furnished:

a. Fertile, friable, naturally occurring. Free of stones, clay, lumps, hardpan, roots, stumps, branches, sticks and other debris larger than two (2) inches in any dimension; free of noxious weeds, grasses, seeds, plants, extraneous matter and any substance harmful to plant growth. Topsoil from open fields will not be accepted.

b. Ph: 5.0 to 7.0
c. Organic Matter: 5% to 10%
d. Sand: 50% to 70%
e. Silt: less than 30%
f. Clay: 10% to 25%
g. Permeability Rate of 5 x 10 <-3> centimeters or greater at 85% compaction.

B. Notify Engineer of location of proposed topsoil for his inspection before testing or transporting to site.

C. Topsoil testing for furnished topsoil: Sample and test, minimum of three (3) samples, for compliance with specified characteristics. Tests to be performed by soil testing lab approved in advance by Engineer, by this Contractor at his expense. Submit Soil Test Reports to Landscape Architect for approval before transporting topsoil. Amend per recommendations of Soil Test Report and as approved to meet specified characteristics.

2.2 SOIL AMENDMENTS:

A. Fertilizer:

1. Characteristics:

a. Uniform in composition.
b. Dry and free-flowing.
c. Commercially available.
d. Conforming to the State of Federal Fertilizer Laws.

2. Of the formulation recommended in the Soil Test Report as specified.

B. Lime:

1. Ground or crushed agricultural lime.
2. Containing not less than 85% of total carbonates.
3. 90% passing 20-mesh screen.
4. Not less than 50% passing a 60-mesh screen.
5. Dry and free-flowing.
6. Apply at rate specified in Soil Test Report.

2.3 LANDSCAPE PLANTING MATERIALS:

A. Water:

1. Provide fresh water, free of impurities or any substance harmful to plant growth.

2. Provide all hose, attachments, and accessories necessary to complete the Work

as specified.

B. Topsoil: Refer to Paragraph 2.1.A, this Section, for specified topsoil for use in all planting operations.

C. Topsoil Mix:

1. Prepare all topsoil mix used in tree and shrub pits and ground cover beds in the following proportions:

a. 2 parts by volume topsoil as specified. 2.1.A.
b. 1 parts by volume decomposed organic matter, 2.3.E.

2. Add three (3) pounds of 12-6-6 fertilizer to each cubic yard of topsoil mix during the mixing process, for all plants.

D. Decomposed Organic Matter:

1. Well rotted organic matter.

2. Containing no weeds, grasses or plants, their seeds, or any substance harmful to plant growth.

3. Of uniform composition.

4. Acceptable Materials:

a. Mushroom Compost
b. Ground pine bark
c. Approved equal.

E. Mulch:

1. Pine straw on slopes: Free from leaves, twigs, insects, grasses, weeds, plants and their seeds, other foreign material and any substances harmful to plant growth.

2. Ground Pine bark: Free from leaves, twigs, insects, grasses, weeds, plants and their seeds, other foreign material and any substances harmful to plant growth.

F. Solid Sod:

1. Obtain solid sod from sources having growing conditions similar to the area to be planted.

2. Sod shall be true to name and type of the species named in the plant Schedule.

3. Sod shall be 100 percent of the type specified and shall contain no other grasses.

4. Sod shall be well cultivated and weed, disease and insect-free, of good texture, and free from extraneous roots, stones and other foreign material. The presence of nutgrass or other weeds shall be cause for rejection and replacement prior to Substantial completion, or during the Guarantee Period.

I. Plant Material:

1. Definition: Trees and shrubs listed in the Plant Schedule in the Drawings.

2. General:

a. Species, sizes, manner in which to be planted, and approximate quantities to complete the planting as indicated are included in the Plant Schedule.
b. Scientific and common plant names conform to those given in *Hortus Third*, or are those generally accepted in the nursery trade.

3. Quality:

a. Conform to the standards set forth in *American Standard for Nursery Stock.*
b. Standard quality and first-class representatives of their species or variety and true to name and type.
c. Nursery-grown, unless specified otherwise.
d. In compliance with State and Federal laws relating to disease and insect infestation; file certificates with Landscape Architect.
e. Having normal, well-developed branches and vigorous root systems, free from defects, decay, disfigurements, sun scaled, bark abrasions, plant diseases, insect pests or eggs, borers and any and all infestations.

4. Rejection of plants for:

a. Lack of compactness or proper proportion;
b. Week, thin growth in rows too close together;
c. Cut back from larger stock to meet specified requirements;
d. Undersized, dry, cracked or broken balls, or plants that are loose in their balls;
e. Root bound within container or ball;
f. Lacking proper proportion as to height and spread and specified characteristics or plant material;

5. Size:

   a. Sizes and proportions of all plant materials shall equal those recommended by the *American Standard for Nursery Stock* for specified grades.
   b. Measure plants before pruning, with branches in normal position.
   c. Equal or exceed measurements specified in Plant Schedule, which are the minimum acceptable; provide 50-percent of plant material maximum size specified.
   d. Height and spread dimensions: General body mass of plant, not from branch tip to tip.
   e. Well-proportioned as to height; reject plants which meet specified measurements but do not possess an overall balance.

   f. Take caliper measurement on trunk six-inches above natural ground level up to and including four-inch caliper size; twelve-inches above natural ground level for larger sizes.
   g. B&B plants shall have firm natural balls of a diameter and depth not less than that recommended in *American Standard For Nursery Stock.*
   h. Container-grown plants: Conform to standards set forth in *American Standard For Nursery Stock* for container-grown plants.

6. Quantity: Furnish plants in sufficient quantity to satisfy the intent of the Drawings and Specifications. Locate in sufficient quantity to that time is not lost if some plants are rejected.

J. Guying and Staking Materials:

1. Wood Stakes:

   a. Pressure-treated Southern Yellow Pine, or other approved wood, 2-inches x 4-inches x length specified in the Drawings, pointed at one end.
   b. Free from insects and fungi.

2. Wire: Pliable #10 or #12 gauge galvanized steel wire, doubled and twisted.

3. Turnbuckles: As detailed and approved by Landscape Architect.

4. Protective Hose:

   a. Reinforced fiber-bearing rubber hose.
   b. Black.
   c. May be second-hand.
   d. Not less than 2-inches inside diameter.

K. Steel Edging

1. Black polypropylene, 16 (mils.) thickness

a. Acceptable product: 10' x 14ga x 4" Commercial Edging, Manufacturer: Col-met, 3333 Miller Park South Garland, TX 75042 Tel.: (972)494-3900
b. Approved equal.

K. Weed Barrier Fabric

1. Black polypropylene, 16 (mils.) thickness

a. Acceptable product: Pro 5(20 yr, 5oz) Manufacturer: DeWitt Company Highway 61 South, RR3, Box 31, Sikeston, Missouri 63801
b. Approved equal.

SECTION 3 - EXECUTION

3.1 INSTALLATION:

A. Planting Season:

1. A period of acceptable weather conditions, during seasons in which satisfactory results can be expected as determined by acceptable practice in the locality and approved by the Landscape Architect.

2. Commence planting operations as soon as portions of the site are available, as approved by the Landscape Architect.

B. Site Inspection:

1. Examine areas and conditions under which Work is to take place.

2. Inform Landscape Architect in writing, prior to planting, of conditions existing which could be considered detrimental to the successful planting and growth of any plant material, including but not limited to, subsurface drainage conditions, utility locations, subgrade compaction, percolation rate and elevations.

C. Site Preparation:

1. Subgrade will be established by others at 2-inches below finished grade in all

areas to receive planting, and 1-inch for areas to be sodded, unless greater topsoil depth is indicated herein or on Drawings for deeper bed preparation.

a. Topsoil depth for shrub and groundcover beds is 6-inches and is by this Contractor (4" by others, 2" by this contractor).
b. Do not place or spread topsoil in an area until subgrade is approved by Landscape Architect and is acceptable to this Contractor.

2. Remove all vegetative growth from topsoil by approved means before commencing with planting operations.

3. Remove all unwanted vegetative growth from areas designated to receive new planting or sod with chemical herbicide or by other approved means, prior to scarifying and placing topsoil.

4. Remove extraneous matter measuring 1-2-inch or larger in any dimension from top 4-inches of placed topsoil.

5. Uniformly grade areas including adjacent transition areas to line and grade shown on Drawings.

6. Obtain approval of finished grades before proceeding with planting operations; eliminate irregularities and ponding.

7. Protect stockpiled or spread topsoil from erosion by force of wind, water, or other force; re-establish eroded, rutted or settled grades to proper finished grade.

D. Topsoil Mix:

1. Prepare topsoil mix to specification 2.3.C off site, using approved topsoil.

2. Obtain approval of topsoil mix before delivery to site, and prior to commencing planting operations. Do not mix in place with placed topsoil.

3. Place topsoil mix as backfill for tree and shrub pits and beds as drawn. Place 2-inches of topsoil mix in all shrub beds unless otherwise indicated on the Drawings.

4. Protect stockpiled topsoil mix from erosion by force of wind of water, or damaged by traffic.

E. Plant Location Staking:

1. Stake plant locations and areas for approval prior to planting.

2. Do not dig plant pits prior to obtaining Landscape Architect's approval of plant locations.

3. Make adjustments in plant locations as directed.

4. If underground obstructions are encountered in planting areas that would prevent the installation of the plant material, contact the Landscape Architect immediately. Alternate locations may be selected by the D & D at no additional cost to the Owner.

F. Planting:

1. Place plants comprising a planting composition in approved staked locates for approval by Landscape Architect.

2. Planting pits and beds:

a. Drainage:

1) This Contractor is responsible for achieving and maintaining adequate drainage from all planting beds. Use specified drainage system, or other approved means, in all tree pits.

2) 48-hours prior to planting, test each plant pit for adequate drainage.

3) Owner reserves the right to test tree or plant pits at any time, before or after planting, for adequate drainage. Correct immediately any inadequate drainage encountered.

b. Pits are generally circular in outline with vertical sides.
c. Tree pits: 3-feet greater in diameter than ball or root spread.
d. Shrub pits: 1-foot greater in diameter than ball or root spread.

e. Excavate to specified dimensions and dispose of excavated material off site.
f. Prepare as specified in detail Drawings.

3. Setting plants:

a. Set plants uniformly 2-inches to 4-inches higher than surrounding grade or as necessary to provide adequate positive drainage away from roots. Slope soil gradually from saucer.
b. Cut rope, wire or string from top of ball after plant has been set; turn down and bury burlap.

4. Backfilling plants:

   a. Backfill to 2/3 full with specified topsoil mix.
   b. Water thoroughly to eliminate air pockets and settling before filling to grade.
   c. Form shallow saucer at plant pit edge to hold water.
   d. Water in thoroughly.

5. Staking:

   a. Inspect tree trunks for injury, improper pruning and insect infestation; take corrective measure.
   b. Immediately after planting, stake trees as detailed.

6. Pruning:

   a. Do not prune plants without approval.
   b. Prune after plants are in place and *ONLY* at the direction of Landscape Architect.
   c. Main leaders of trees to remain intact.
   d. Paint all cuts over 2-inch diameter with approved tree wound dressing.

7. Finished Grading: Handgrade and rake planting areas so that grades conform to surrounding areas and surface water drains freely.

8. Mulching:

   a. Mulch all plant pits and beds with 4-inch deep specified mulch.
   b. Spread mulch solid in planting beds.
   c. Thickness is uniform throughout.
   d. Mulch for trees shall be eight (8) feet in diameter from base of tree.

G. Solid Sod:

1. Procure and handle sod per ALDOT Section 860.05(b) 1-4.

2. Preparation of Sod Bed:

   a. Spread and scarify amended topsoil as specified.
   b. Rake and otherwise manipulate to form smooth-draining grades, remove all stones and clay lumps 1-inch in diameter or larger.
   c. Leave the surface of the topsoil 1- 1/2-inches below finished grade.
   d. Do not move heavy objects over areas to be sodded after the soil has been prepared. Planting in compacted areas will not be permitted.

e. The finished surface of the areas to be sodded shall be approved by the Landscape Architect prior to sod placement.

3. Solid Sod Placement:

a. Lay sod when sod bed is not excessively wet or frozen, but when soil is damp for a depth of 4-inches.
b. Immediately upon approval of bed preparation, lay sod smoothly, edge-to-edge, with staggered joints.
c. Press firmly into contact with sod bed by tamping or rolling by approved means to eliminate all air pockets, providing a true and even surface, and assuring knitting.

d. Fill cracks between sod blocks with strips of living sod, topsoil, or humus.
e. Water thoroughly by use of sprinkler or spray, without erosive force.

3.2 LANDSCAPE MAINTENANCE:

A. Provide labor, materials, equipment and means for proper maintenance of all materials and workmanship included in the Work of this Section until Substantial Completion and the beginning of the 30-day maintenance period.

B. Maintenance for 30 days after Substantial Completion is included in the Work of this Section.

3.3 SUBSTANTIAL COMPLETION and GUARANTEE:

A. Substantial Completion and Payment:

1. Submit request for inspection of Substantial Completion, with a punch list of contract items to complete, to Landscape Architect at least 1-week prior to anticipated date of inspection.

2. Review the Work jointly with the Landscape Architect for Substantial Completion.

3. Upon completion of repairs and replacements found necessary at time of review, the Landscape Architect will confirm the Date of Substantial Completion of the Work.

4. Substantial Completion constitutes the beginning date of the 2-Year Guarantee Period per the city Landscape Ordinace.

B. Basis of Acceptance:

1. Planted trees and shrubs will be counted as individual units, complete, in place and planted in accordance with plans and specifications. Each unit will include the installed plant, topsoil, topsoil mix, mulch and staking apparatus.

2. Solid sod will be counted in square yards provided and installed, including sod, ground preparation and topsoil, in accordance with plans and specifications.

3. Plant pit drainage will be counted as incidental to the Work, and will not be counted separately for payment.

4. The cost of mobilization (including all provisions of General Requirements, and Maintenance until Substantial Completion as specified herein are considered incidental to the Work and will not be counted as separate items for payment.

C. Guarantee:

1. Guarantee all materials and workmanship for a period of 2-years from the Date of Substantial Completion.

2. During the period of the Guarantee, replace with no additional compensation, and as soon as weather permits, all dead plant materials and all materials not in a thriving condition; replace all other workmanship and materials which are unsatisfactory in the opinion of the Landscape Architect; make good any other damage, loss, destruction, or failure to flourish sufficiently as the result of inferior or defective materials or workmanship, including, but not limited to inadequate drainage.

3. All replacement material shall match the size attained by original materials at the time of the replacement.

4. Remove dead or dying material from the site within 5 days of notice, refer to section 1.6 paragraph F(4).

5. Repair grades and other Work necessitated due to planting replacements.

6. If the replacement is not acceptable during or at the end of the Guarantee Period, the Owner may elect either subsequent replacement or credit. Replacements shall have a 1-year Guarantee from date of replacement.

7. Guarantee applies to losses or damage other than those due to vandalism, Owner neglect, or Acts of Nature, as determined by the Landscape Architect. Acts of Nature, but may not be limited to, high winds of hurricane or tornado force, sleet, hail, freezing rain, and extreme cold (as determined by the Landscape Architect). Contractor agrees to replace losses due to Acts of Nature at fifteen

percent (15%) less than original contract price for the damaged work.

3.4 FINAL INSPECTION and ACCEPTANCE:

A. Contractor is responsible for contacting the Landscape Architect at the end of the Guarantee Period to schedule final inspection. Should the Contractor fail to contact the Landscape Architect at this time, the Guarantee Period is automatically extended until he does so.

B. At the end of the Guarantee Period, submit request for inspection for Final Acceptance to Landscape Architect at least 1-week prior to anticipated date of inspection; include list of Work substantially accepted and list of Work replaced during Guarantee Period.

C. Upon request for inspection, jointly review with Landscape Architect all guaranteed Work for Final Acceptance.

D. Remove tree staking apparatus and saucers from all trees, unless otherwise directed; replace mulch to specified thickness.

E. Upon completion by the Contractor of all required repairs and replacements, the Landscape Architect will confirm the date of Final Acceptance of the Work.

END OF LANDSCAPE WORK

SECTION 32 9700
LANDSCAPE MAINTENANCE

1.0 GENERAL

1.1 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, apply to the work specified herein.

1.2 DESCRIPTION AND SCOPE OF WORK:

A. Provide all labor, products, equipment and services necessary to maintain site landscape work for TWO (2) YEARS after substantial completion.

B. Maintenance includes maintaining all landscape and site work as described herein; The removal of trash, litter, blowing paper, debris, dust and mud from landscape areas and other areas littered as a result of maintenance operations is included.

C. Maintain all plants in a growing, well formed, healthy, and thriving condition, by watering, fertilizing, pruning, spraying, weeding, straightening, replacement, or by other necessary maintenance operations.

1.3 SUBMITTALS:

A Qualification data for firms specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include a list of a minimum of five (5) similar projects completed within the last five (5) years with project name, address, names of Architects and Owners, overall description of scope of work, and contract value.

B. Product Data:

1. Submit manufacturer's product literature, instructions and guaranteed analysis for fertilizer.

C. Maintenance Manual: In a 3-ring binder, typewritten schedule and procedures for annual landscape maintenance program and procedures, with monthly maintenance guidelines, by Contractor.

1.4 JOB CONDITIONS:

A. Coordinate the Work of this Section with that of other trades.

B Examine conditions under which Work is to be performed and notify Owner in writing of unsatisfactory conditions.

D. Determine the extent of underground utilities and impact on proposed installation and maintenance operations.

1.6 QUALITY ASSURANCE:

A. Codes and Standards:

1. All plant materials to comply with State and Federal laws relating to inspection for disease and insect control.

2. Plant material quality to conform to *American Standard for Nursery Stock*, American Association of Nurserymen, Inc., 1986, ANSI Z-60.1.

3. Plant Material nomenclature to conform to:

   a. *Hortus Third*, a Concise Dictionary of Plants Cultivated in the United States and Canada, MacMillan Publishing Company, Inc., New York, 1976 Edition.
   b. Names not listed in the above standard to comply with those most commonly used in the trade.
   c. In all cases, botanical names take precedence over common names.

4. Applicable Sections of the Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction, 2001 edition.

B. Contractor Qualifications:

1. Alabama General contractors License for Classification S - Specialty Construction, Sub-classification 4 - Landscaping.

2. Firm experienced in the successful installation of a minimum of five (5) projects within the past five (5) years similar in scope, quality, and contract value to that indicated for this project. Firm shall have sufficient manpower, equipment and financial resources to complete the Work of this Section.

C. Supervision:

1. Scheduling, operations, installation, and maintenance shall be supervised by a person(s) having one or more of the following qualifications:

   a. Is a Certified Nurseryman.
   b. Is a Licensed Horticulturist.
   c. Has a State Setting and Maintenance License.

D. Inspection and Approval:

1. Immediately remove from site plant materials or other materials not complying with specified requirements.

2. Approval is for visual qualities only and does not relieve the Contractor of his obligation to provide materials and workmanship in full compliance with the requirements of the Contact Documents.

1.7 PRODUCT DELIVERY, STORAGE and HANDLING:

A. Deliver packaged materials in manufacturer's original containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery, and while stored at the site.

B. Deliver all non-packaged or non-containerized materials to site in a manner that will prevent loss, damage, deterioration or contamination.

C. Store all materials in approved locations to prevent loss, damage, deterioration or contamination.

D. Deliver, storage and handling of all plant materials shall conform to ALDOT Specification Section 860.06(c) and the following:

1. Deliver freshly dug plants, which have not been in cold storage or heeled-in.

2. Do not prune prior to delivery.

3. Do not bend or bind trees or shrubs in such a manner as to damage bark, break branches or destroy natural shape.

4. Provide protective covering during delivery.

5. Deliver plants after preparations for planting have been completed and approved, and plant immediately.

1.8 SITE MAINTENANCE:

A. Keep roads, paving and structures adjacent to maintenance operations clean and free of obstructions, mud and debris at all times.

B. Do not permit flushing of roads or disposal of dirt or debris into sewers or drainage ditches.

C. Control dust from maintenance operations.

SECTION 2.0 - PRODUCTS

2.1 WATER:

A. Owner provides potable water.

B. Contractor provides necessary hose, attachments, and accessories.

2.2 TOPSOIL:

A. Topsoil necessary to perform or complete maintenance operations, repair or replacement is to be provided by Contractor. Furnish from approved off-site source in sufficient quantity to complete all operations.

B. Prepare all topsoil used in tree and shrub pits and ground cover beds in the following proportions:

1. 2 parts by volume topsoil as specified.
2. 1 part by volume decomposed organic matter.

C. Add three (3) pounds of 12-6-6 fertilizer to each cubic yard of topsoil mix during the mixing process, for all plants.

D. Test at least three (3) samples for compliance.

E. Characteristics:

1. Fertile, friable, naturally occurring. Free of stones, clay, lumps, hardpan, roots, stumps, branches, sticks and other debris larger than two (2) inches in any dimension; free of noxious weeds, grasses, seeds, plants, extraneous matter and any substance harmful to plant growth. Topsoil from open fields will not be accepted.
2. pH: 5.0 to 7.0
3. Organic Matter: 5% to 10%
4. Sand: 50% to 70%
5. Silt: less than 30%
6. Clay: 10% to 25%
7. Permeability Rate of 5 x 10 <-3> centimeters or greater at 85% compaction.

2.3 SOIL AMENDMENTS:

A. Fertilizer:

1. Uniform in composition, dry and free flowing.
2. Commercially available.
3. Mixed per soil test report recommendations.
4. Acceptable Manufacturers:

    a. Sta-Green Plant Food Company; Nursery Special.
    b. O.M. Scott and Sons, Inc.; Scott's.
    c. W.R. Grace & Company; Peter's 20-20-20 (for deep root feeding trees).
    d. Approved substitution.

B. Lime:

1. Ground or crushed agricultural lime.
2. Containing not less than 85% of total carbonates.
3. 90% passing 20-mesh screen.
4. Not less than 50% passing a 60-mesh screen.
5. Dry and free flowing.
6. Apply at rate specified in Soil Test Report.

C. Decomposed Organic Matter:

1. Well rotted.
2. Containing no weeds, grasses or plants, their seeds, or any substance harmful to plant growth.
3. Of uniform composition.
4. Acceptable Manufacturers:

a. Klumb Company; "Soil Conditioner."
b. Approved equal.

2.4 MULCH:

A. Pine straw.

1. Free from wood, cambium, sawdust, leaves, twigs, insects, grasses or weeds, their seeds, other foreign material and any substance harmful to plant growth.

2.5 PLANT MATERIALS:

A. Plant Material:

1. Trees, shrubs and ground covers as shown and scheduled. Provide and install species, sizes and quantities shown and scheduled; standard quality, first-class representatives of each species or variety, true to name and type; nursery-grown, unless otherwise shown or scheduled.

2. Conforming to standards in American Standard for Nursery Stock.

3. Having normal, well-developed branches and vigorous root systems.

4. Complying with State and Federal laws for disease and insect infestation.

5. Healthy, vigorous, free from defects, decay, disfigurements, sun-scald injuries, abrasions of the bark, plant diseases, insect pests or eggs, borers, and all forms of infestations or objectionable disfigurements.

6. Reject plants lacking compactness or proper proportions, plants that are weak, thin or injured from too-close planting in nursery rows.

7. Plants which have been cut back from larger grades to meet certain specified requirements will be rejected.

8. Plants with undersized, dry, cracked, or broken balls, or which are loose in their balls will be rejected.

9. Balled and burlapped material: Root-pruned within last two (2) years.

10. Container-grown material: Grown for one (1) growing season in the container in which it is delivered; free from weeds and grasses. Root-bound material will be rejected.

11. Size:

a. In accordance with *American Standard for Nursery Stock*.
b. Measure plants before pruning, with branches in normal position.
c. All replacement material shall match the size attained by original materials at the time of replacement.

d. Height and spread dimensions: General body mass of plant, not from branch tip to tip.
e. Well-proportioned as to height; reject plants which meet specified measurements but do not posses an overall balance.
f. Take caliper measurement on trunk six-inches above natural ground level up to and including four-inch caliper size; twelve-inches above natural ground level for larger sizes.
g. Balled and burlapped plants shall have firm natural balls of a diameter and depth not less than per American Standard for Nursery Stock.

2.6 CHEMICAL WEED CONTROL:

A. Pre-Emergent (in bed areas):

1. Selective pre-emergent with no residual soil activity. Active ingredient: Trifluralin.
2. Commercially available.
3. Adhere to manufacturer's recommendations for strength, rate, and method of application.
4. Acceptable Manufacturers:

a. Elanco: Treflan.
b. Approved substitution.

B. Herbicide:

1. Non-selective post-emergent with no residual soil activity. Active ingredient: Isopropylamine salt of Glyphosate.
2. Commercially available.
3. Adhere to manufacturer's recommendations for strength, rate and method of application.
4. Acceptable Manufacturers:

a. Monsanto Agricultural Products Company: Round Up.
b. Approved substitution.

2.7 GUYING and STAKING:

A. Wood Stakes:

1. Pressure-treated Southern Yellow Pine or other approved wood, 2-inches x 4-inches x length specified in the Drawings, pointed at one end.
2. Aboveground portion painted black.
3. Free from insects and fungi.

B. Wire: Pliable #10 or #12 gauge galvanized steel wire, doubled and twisted.

C. Turnbuckles: As detailed and approved by Architect.

D. Protective Hose:

1. Reinforced fiber-bearing rubber hose.

2. Black.
3. May be second-hand.
4. Not less than ½-inches inside diameter.

2.8 SHRUB BED DRAINAGE:

A. Washed pea gravel for drainage fill.

B. Filter Fabric: SUPAC 5-P manufactured by Phillips Fibers Corporation, or approved substitution.

C. Corrugated perforated drainage tubing: Four-inch diameter corrugated polyethylene drainage tubing, wrapped in filter fabric.

1. Acceptable Product: ADS Drain Guard #472 manufactured by Advanced Drainage Systems, Inc.
2. Approved substitution.

SECTION 3.0 - EXECUTION

3.1 GENERAL:

A. Provide maintenance according to:

1. Guideline performance specifications herein.
2. Monthly maintenance guidelines herein.
3. Accepted horticultural practices and techniques.
4. Manufacturer's recommendations for material use.
5. Applicable State laws and local ordinances.

3.2 WATERING:

A. General Watering:

1. Water during early morning hours (2:00 am - 7:00 am).
2. Should irrigation system, or any portion of that system, fail to function, hand water until system is made functional again.
3. Do not over-water; water should never be allowed to stand in any areas for long periods of time.
4. Maintain uniform moisture in all planting areas during winter, especially when a freeze is expected.
5. Heavy clay soils hold moisture longer periods of time; sandy lighter soils drain rapidly and need to be watered more frequently.

B. Trees: Deep water all newly planted trees once every week during the summer, and the winter as necessary. This schedule should be adjusted to the amount of rain. However, unless it has rained at least ½-inches in twenty-four (24) hours, continue to deep water. Check trees monthly to determine if root ball is well drained. Take permanent corrective measures.

C. Shrubs: Water shrubs as necessary to maintain sufficient uniform moisture in bed; usually three

(3) to four (4) times weekly or more frequently if needed during the summer.

3.3 FERTILIZING:

A. Fertilize trees, shrubs and lawns per manufacturer's recommended rates in accordance with the monthly maintenance guideline herein.

B. Cultivate and water beds or pits thoroughly after application.

C. Adjust fertilizer in accordance with interim Soil Test Reports.

3.4 PRUNING:

A. Remove dead wood and sucker growth as it becomes evident.

B. Do not top or remove terminal growing point or 'leader' of any plant.

C. Review pruning practices with Architect before pruning any living portion of any plants.

D. Crape myrtles will be pruned ONLY as directed by owner’s representative.

E. Maintain height of evergreen hedges at 36”-42” height.

3.5 INSECT AND DISEASE CONTROL:

A. Maintain all plants and grass in a pest and disease-free condition by approved means.

B. Observe all applicable laws, statues, and ordinances regulating the purchase, use, application, and licensing for all pesticides.

C. Where possible, combine approved insecticide and fungicide to provide maximum protection for all plants.

D. Follow manufacturer's recommendations.

E. Observe all safety precautions.

F. Trees: Inspect for pests and diseases. Spray for insect and disease control only as infestations are noted. Control shall be specific.

G. Shrubs: If insect or disease infestation occurs, treat and continue treatment until complete eradication.

3.6 WEEDING:

A. Keep all lawn and planting areas weed free on a continuous basis by approved means.

B. Minimum weeding:

1. Two (2) applications of chemical pre-emergent spray, approved.
2. Five (5) applications (during growing season) of chemical contact spray (Round Up by Monsanto, or equal, approved).
3. One (1) day per month hand weed during the period of March 1st through September 30th; remove all visible weeds.

4. Weed to remove visible weeds during the winter.

3.7 SOD MAINTENANCE:

A. Mowing: Mow and edge lawn areas during the growing season, approximately April 1 through November 15 (year-round if overseeded with Winter Rye). Remove grass clippings from the site. Adhere to the following mowing schedule:
1. Mow and edge sod areas weekly as needed.
2. Change mowing directions to prevent rutting of grass.
3. Mowing heights: Bermuda -- 1"-1 ½"
Zoysia -- 1 ½"-2"
Fescue -- 2 ½"-3 ½"

All mowing operations are to be completed in one day.

B. Thatch Removal: Thatch removal shall occur once each year at all sod areas or as required by the Owner. Thatch shall be generally removed during early spring or mid-autumn. De-thatch using approved equipment for this purpose.

C. Core Aerating: Aeration of sod areas shall occur once each year during mid-spring or late summer using approved core aeration equipment, especially manufactured for this specific purpose. Remove cores from site.

3.8 MULCHING:

A. Keep planting areas neat and uniformly mulched to 3” depth on a continuous basis.

B. In addition to replacing and re-spreading mulch as necessary, completely replenish pine straw mulch in all planting areas twice each year in March and November.

C. Areas of dense ground cover, such as Asian jasmine do not require pine straw mulch.

3.9 STRAIGHTENING:

A. Maintain plants in their stable upright position and at the proper grade by straightening and tightening staking and guying apparatus, raising plants which have settled, and by other means.

3.10 CLEAN-UP:

A. Keep all planting areas neat, weeded and uniformly mulched on a continuous basis.

B. Clean-up adjacent walks and pavement where littered as a result of maintenance operations.

C. Remove trash and debris from surface of planting areas, whether as a result of maintenance operations or otherwise.

3.11 MONTHLY MAINTENANCE GUIDELINES:

A. January:
1. Prune trees and shrubs that have become too large or out-of-shape.
2. Inspect plants, shrubs and trees and remove any damaged or dead wood.
3. Inspect planting areas and remove any debris or litter.
4. Check staking and weather protection of first year plants.
5. Remove leaf and litter on all lawn areas weekly.
6. Mulch bed areas as needed to replenish mulch levels.
7. Spray herbicides on winter weeds around January 15th.
8. Take soil samples.
9. Transplant any trees and shrubs.
10. Replace any damaged or dead trees and shrubs.
11. Check moisture level in all planted areas and water if necessary.
12. Check drainage of planted areas, correct if excessive water persists.
13. Fertilize pansies every two weeks or as needed to maintain heavy growth and flowering. Use nitrate based fertilizer.
14. Mow lawn areas every ten days if overseeded with winter grass.

B. February
1. Prune trees and shrubs that have become too large or out-of-shape.
2. Inspect plants, trees and shrubs and remove any damaged or dead wood.
3. Inspect planted areas and remove any debris or litter.
4. Remove leaf and litter on all lawn areas weekly.
5. Apply pre-emerge herbicides to lawn to prevent crabgrass.
6. Apply pre-emerge herbicides to beds to prevent weeds.
7. Replace any damaged or dead trees or shrubs.
8. Check moisture level in all planted areas and water if necessary (weekly).
9. Protect plants susceptible to cold damage during excessive cold periods if possible.
10. Mow lawn area every ten days if overseeded with winter grasses.
11. Spot spray any existing weeds with Round-Up.
12. Establish a good edge on all bed areas.
13. Completely replace and replenish mulch in all planting areas.

C. March
1. Dethatch all lawn areas that have thatch build-up.
2. Mow and trim all lawn areas as needed.
3. Inspect plants, trees and shrubs and remove any damaged or dead wood.
4. Litter removal on all lawn areas.
5. Check moisture level in all planted areas and water if necessary (weekly).
6. Start pruning where necessary to maintain shape and form (do not shear).
7. All Liriope should be cut back to allow new growth to come out and remove winter damage to old growth.
8. Hand weed all bed areas as needed.
9. Deep-root feed all trees except pines (Peter's 20-20-20) as requested.
10. Completely replace and replenish mulch in all planting areas.

D. April
1. Fertilize all lawn areas with 32-3-12 analysis, with 50% slow release nitrogen, or equal to soil sample reports.

2. Lime lawn areas as per soil sample reports.
3. Mow and edge lawn areas weekly.
4. Fertilize shrubs, trees, groundcover area with Nursery Special by Sta-Green or equal.
5. Cultivate and weed all planted areas.
6. Inspect all planted areas and remove any dead plants and replace.
7. Inspect all plant material (shrubs and trees) and prune any dead limbs.
8. Spot spray any weed problem areas.
9. Clean up any litter on lawn.
10. Inspect all areas for insect and disease damage and treat as necessary (weekly).
11. Prepare bed areas for any annual color and plant after mid-April.
12. Remove any winter and/or early spring color after blooming.
13. Water lawns and planted areas as needed.
14. Prune shrubs after they have bloomed.
15. Inspect all plants and trees for insects and/or diseases and treat as necessary.
16. Prune hedges to keep shape and form as necessary.
17. Hand weed all bed areas as needed.
18. Apply preventive spray for lacebug and leafminer.
19. Plant annual color beds for summer.

E. May
1. Irrigate all planted and lawn areas as needed.
2. Mow and edge all lawn areas weekly.
3. Spot spray for weeds in planted and natural areas with Round-Up.
4. Weed all groundcover and bed areas as necessary.
5. Clean up litter on lawn and hard surface areas (weekly).
6. Inspect all lawn and planted areas for insects and/or disease and treat as necessary.
7. Prune shrubs and hedges as necessary to keep shape and form.
8. Apply selective herbicides for weed control particular to each variety of lawn.
9. Prune any damaged plants.

F. June
1. Irrigate all planted and lawn areas as needed.
2. Mow and edge all lawn areas weekly.
3. Trim all lawn areas as needed.
4. Spot spray for weeds in all planted areas with Round-Up.
5. Weed all groundcover and bed areas as necessary.
6. Clean up litter on all lawn areas.
7. Inspect all lawn and planted areas for insects and/or disease and treat as necessary.
8. Prune shrubs and hedges as necessary to keep shape and form.
9. Apply selective herbicides for weed control particular to each variety of lawn.
10. Fertilize lawn areas .
11. Fertilize all bed areas.
12. Hand weed all bed areas as needed.

G. July
1. Irrigate all planted and lawn areas as needed.
2. Mow and edge all lawn areas weekly.
3. Hand weed all bed areas as needed.
4. Spot spray with Round-Up on weeds in all planted areas where applicable.
5. Clean up litter on all hard surface and lawn areas weekly.

6. Inspect all lawn and plant areas for insect and/or disease and treat as necessary.
7. Prune shrubs and hedges as necessary to keep shape and form.
8. Check all bed areas for mulch replacement as needed.

H. August
1. Irrigate all planted and lawn areas as needed.
2. Mow and edge all lawn areas weekly.
3. Hand weed all bed areas as needed.
4. Spot spray with Round-Up on weeds in all planted areas where applicable.
5. Clean up litter on lawn areas weekly.
6. Inspect all lawn and plant areas for insect and/or disease and treat as necessary.
7. Prune shrubs and hedges as necessary to keep shape and form.
8. Fertilize all lawn areas in late August-early September with 8-8-25 analysis (low nitrogen).
9. Fertilize all groundcovers and bed areas.
10. Check all bed areas for mulch replacement as needed.

I. September
1. Irrigate all lawn and planted areas as necessary.
2. Mow and edge all lawn areas weekly.
3. Hand weed bed areas as needed.
4. Clean up litter on lawn areas.
5. Inspect all lawn and planted areas for insects and/or disease and treat as necessary.
6. Prune shrubs and hedges as necessary to keep shape and form.
7. Apply pre-emergent to all Bermuda or Zoysia lawns unless over seeding with Winter Rye.
8. Apply pre-emergent to all bed areas.
9. Apply lime if soil tests show pH is low on lawn areas.
10. Fertilize fall color beds.
11. Remove any summer color beds and replace with fall color.
12. Take soil test if necessary for lime and fertilizer requirements.

J. October
1. Mow and edge all lawn areas weekly.
2. Monitor water needs.
3. Clean up litter on all lawn areas.
4. Inspect all lawn and planted areas for insects and/or disease and treat as necessary.
5. Prune any damaged plants.
6. Remove leaves from all planted and lawn areas.
7. Plant pansies for winter color.
8. Replace and/or plant any new trees or shrubs.
9. Dethatch all lawn areas that have thatch build-up.

K. November
1. Clean up all litter and leaves on lawns.
2. Mow, edge and trim all lawn areas where applicable.
3. Check mulch in beds and replace where necessary after fall leaf drop. Replenish pine straw mulch.
4. Check all planted areas for water requirements.
5. Weed and cultivate beds for winter.

6. Winterize irrigation system.

L. December
1. Clean up all litter and leaves on lawns.
2. Mow, edge and trim all lawn areas where applicable.
3. Check all planted areas for water requirements.
4. Fertilize winter color beds with liquid fertilizer two times.

3.12 INSPECTION and ACCEPTANCE:

A. Monthly Review:

1. Submit a request for inspection of Maintenance Work to the Owner once a month from April through September and every two (2) months from October through March.

2. Review the previous month's work jointly with the Owner.

3. Submit a written log of fertilizer applications, and chemical insect, disease or weed control applications with each Application for Payment. This log will be a complete account of each fertilizer and chemical application performed within the month covered by that Application for Payment including date, time, weather conditions, and specific purpose and product of each application.

B. Basis of Acceptance:

1. Contractor is responsible for landscape maintenance work as specified herein and in keeping with acceptable horticultural practices.

2. During the period of the maintenance contract, replace with no additional compensation, and as soon as weather permits, all dead plant materials and all materials not in a thriving condition; replace all other workmanship and materials which are unsatisfactory in the opinion of the Owner; make good any other damage, loss, destruction or failure to flourish sufficiently as the result of inferior or defective materials or workmanship, including, but not limited to, inadequate drainage.

3. All replacement material shall match the size attained by the original material at the time of replacement.

4. Remove dead or dying material from the site within one (1) week of notice from the Owner.

5. Repair grades and other work necessitated due to planting replacements.

6. If the replacement is not acceptable during or at the end of the maintenance period, the Owner may elect either subsequent replacement or credit.

7. Responsibility for replacement or repair work applies to losses or damage other than those due to vandalism, Owner neglect, or Acts of Nature, as determined by the Owner. Acts of Nature include, but may not be limited to, high winds of hurricane or tornado force, sleet,

hail, freezing rain, and extreme cold (as determined by the Owner). Contractor agrees to replace losses due to Acts of Nature at fifteen percent (15%) less than original contract price for the damaged work.

8. The cost of mobilization (including the provisions of General Requirements and General and Supplementary Conditions) as specified herein is considered incidental to the Work and will not be counted as a separate item for payment.

3.13 FINAL INSPECTION and ACCEPTANCE:

A. At the end of the maintenance period, submit request for inspection for Final Acceptance to the Owner at least one (1) week prior to anticipated date of inspection.

B. Upon request for inspection, jointly review with Owner all Work for Final Acceptance.

C. Submit Maintenance Manual (three [3] copies) for Owner's information containing full details for care and maintenance of landscape work, personnel and procedures, and weekly schedule for maintenance.

D. Upon completion by the Contractor of all required repairs and replacements, the Owner will confirm the date of Final Acceptance of the Work.

END OF LANDSCAPE MAINTENANCE

SECTION 33 1000

WATER UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Related work specified elsewhere includes:

1. Section 31 2000 - “Earth Moving”
2. Division 22 – Plumbing

1.2 SUMMARY:

A. This Section includes water service piping system, meter, vaults, valves, and appurtenances from the existing on-site utility source of potable water to a point 5 feet outside the building, and as indicated on the Drawings, and in this Section of the Project Manual.

B. Note that the Contractor shall furnish and install connection, water meter, etc., acceptable to the utility company and call on the utility company to approve the meter and inspect the installation prior to covering.

C. All fees and charges for water service, meters, taps, permits, impact fees, etc., if any, shall be paid by the Contractor from their contract amount.

D. The extent of water service piping system, fire hydrants, etc., is indicated on the Drawings, in this Section, other referenced Sections of the Project Manual, and as otherwise required by authorities having jurisdiction.

1. All water pipe which run under roads, streets, driveways, and other vehicular paving shall be sleeved in AWWA C151 ductile iron sleeves.

E. Utility Compliance: Comply with Authority Having Jurisdiction regulations and standards pertaining to water distribution systems.

1. Where conflicts or discrepancies occur with the plans or these specifications, Authority Having Jurisdiction regulations and standards shall govern.

1.3 SUBMITTALS:

A. General: Submit the following in accordance with conditions of Contract and Division 1 Specification Sections

1. Product data for water service piping and fire protection pipe and specialties.
2. Shop drawings for water vaults, including lids.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS - GENERAL:

A. General: Pipe, valves, fittings and installation in R.O.W. and on site shall comply with requirements of this Section, other referenced Sections of the Project Manual, the Drawings, and the Authority Having Jurisdiction.

1. Pipe, fittings, hydrants and valves shall be as specified herein, subject to acceptance by the Authority Having Jurisdiction, unless other specific materials acceptable to the Authority Having Jurisdiction are indicated on the Drawings.

2. PVC piping and fittings 4" and smaller shall be C900 PVC, Class 200 plastic pipe, Schedule 40, or Type K Copper; and pipe 4" and larger, below paving and fire lines shall be ductile iron, of type(s) acceptable to the Authority Having Jurisdiction, unless other specific materials acceptable to the Authority Having Jurisdiction are indicated on the Drawings.

B. PVC Plastic, Schedule 40 PVC with pressure-rated fittings: Conform to ASTM D 1785 standard specifications for PVC plastic pipe.

C. PVC Plastic, Water Pipe: AWWA C900, Class 200. Include elastomeric seal according to ASTM F477.

1. Ductile Iron Fittings: AWWA C110, ductile-iron; or AWWA C153, ductile-iron, compact type, and specifically designed for joining PVC pipe; Include elastomeric seals according to ASTM F 477 or as otherwise required for joining plastic pipe specified

2. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended in writing by piping system manufacturer, unless otherwise indicated.

D. Where copper pipe is indicated, provide Soft Copper Tube, ASTM B 88, Type K, water tube, annealed temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

E. Ductile-Iron, Push-on-Joint Pipe: AWWA C151 and ANSI C150, C151, A21.50, and A21.15 respectively, Class 350 as approved by the Authority Having Jurisdiction, tar coated outside, with cement lining and seal coat according to AWWA C104. Include rubber compression gasket according to AWWA C111.

1. Ductile-Iron, Push-on-Joint Fittings: AWWA C110, ductile-iron; or AWWA C153, ductile-iron, compact type. Include cement-mortar lining and seal coat according to

AWWA C104 and rubber compression gaskets according to AWWA C111 (ANSI 21.11) and according to ASTM D-3139.

2. Joining Materials: AWWA C111 rubber gaskets and lubricant according to ASTM F477 requirements.

F. Ductile-Iron, Mechanical-Joint Pipe: AWWA C151, with cement-mortar lining and seal coat according to AWWA C104. Include gland, rubber gasket, and bolts and nuts according to AWWA C111.

1. Ductile-Iron, Mechanical-Joint Fittings: AWWA C110, ductile-iron; or AWWA C153, ductile-iron, compact type. Include cement-mortar lining and seal coat according to AWWA C104 and glands, rubber gaskets, and bolts and nuts according to AWWA C111.

2. Joining Materials: AWWA C111 ductile-iron or gray-iron glands, high-strength steel bolts and nuts, and rubber gaskets.

G. PE Encasement for Ductile-Iron Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch (0.20-mm) minimum thickness, tube or sheet.

H. Pipe Sleeves: Provide pipe sleeves at least one size larger than water service piping required below existing concrete and paving, and as follows.

1. Below Concrete, Entry Pads, and Paving Subject to Only Pedestrian Traffic, and for Future Irrigation: Schedule 40 PVC.

2. Below Concrete, Equipment Pads, Dumpster Pads, Valley Gutters, Curbs and Gutters, Paving Subject to Vehicular Traffic, and Where Indicated: Ductile Iron, as specified above herein this Section.

I. Identification for Underground Plastic Pipe:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allen Systems, Inc.; Reef Industries, Inc.
b. Brady (W.H.) Co.; Signmark Div.
c. Calpico, Inc.
d. Carlton Industries, Inc.
e. EMED Co., Inc.
f. Seton Name Plate Co.

2. Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid blue in color with continuously printed caption in blue letters "CAUTION - WATER LINE BURIED BELOW."

PART 3 - EXECUTION:

3.1 INSTALLATION:

A. Comply with requirements of Division 22, the International Plumbing Code, Drawings, the Authority Having Jurisdiction and requirements of other authorities having jurisdiction.

B. Comply with requirements of the State Health Department, the local Health Department, and authorities having jurisdiction.

3.2 DEPTH OF COVER:

A. Provide minimum cover of 36-inches for all water bearing piping.

3.3 INSTALLATION OF IDENTIFICATION:

A. Install continuous plastic underground warning tape during back-filling of trench for underground water service piping. Locate 6 to 8 inches below finished grade, directly over piping.

3.4 CLEANING:

A. Clean and disinfect water distribution piping as follows, or as required by utility company, Code, and authorities having jurisdiction:

1. Purge all new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired, prior to use.

2. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction or, in case a method is not prescribed by that authority, use the procedure described in AWWA C651, or as described below:

a. Fill the system or part thereof with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system or part thereof and allow to stand for 24 hours.

b. Drain the system or part thereof of the previous solution and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.

c. Following the allowed standing time, flush the system with clean, potable water until chlorine does not remain in the water coming from the system.

d. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.

B. Prepare reports for all purging and disinfecting activities, and submit for review and along with each set of “Record Documents”.

END OF WATER SERVICE PIPING

SECTION 33 3000

SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Related work specified elsewhere includes:

1. Section 31 2000 - “Earth Moving”
2. Section 03 3100 - “Concrete”
3. Division 22 - “Plumbing”

1.2 SUMMARY:

A. This Section includes sanitary sewerage system piping and appurtenances from a point 5 feet outside the building to the point of disposal.

B. The extent of sanitary sewerage system is indicated on the Drawings, in this Section 33 3000, and as otherwise required by authorities having jurisdiction.

C. All fees and charges for sanitary sewerage service, taps, connections, permits, impact fees, etc., shall be paid by the Contractor from their contract amount.

1.3 SUBMITTALS:

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

1. Product data for drainage piping and specialties.
2. Test Reports.

1.4 QUALITY ASSURANCE:

A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to sanitary sewerage systems.

B. Utility Compliance: Comply with Authority Having Jurisdiction regulations and standards pertaining to sanitary sewerage systems.

1. Where conflicts or discrepancies occur with the plans or these specifications, the Authority Having Jurisdiction regulations and standards shall govern.

C. Health Department Compliance: Comply with the State Department of Health Code or the local Health Department code, regulations and standards, whichever is more stringent.

D. Comply with requirements of authorities having jurisdiction, when more stringent than specified or otherwise indicated.

1.5 PROJECT CONDITIONS:

A. Site Information: Perform site survey, research public utility records, and verify existing utility locations. Verify that sanitary sewerage system piping may be installed in compliance with original design and referenced standards.

1.6 SEQUENCING AND SCHEDULING:

A. Coordinate any connection to public sewer with the Authority Having Jurisdiction.

B. Coordinate with interior building sanitary drainage piping.

C. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cleanouts:
   a. Ancon, Inc.
   b. Josam Co.
   c. Smith (Jay R.) Mfg. Co.
   d. Wade Div.; Tyler Pipe.
   e. Zurn Industries, Inc.; Hydromechanics Div.

2. Underground Warning Tapes:
   a. Allen Systems, Inc.; Reef Industries, Inc.
   b. Brady (W.H.) Co.; Signmark Div.
   c. Calpico, Inc.
   d. Carlton Industries, Inc.
   e. EMED Co., Inc.
   f. Seton Name Plate Co.

2.2 PIPE AND FITTINGS:

A. Ductile-Iron, Gravity Sewer Pipe and Fittings:

1. Pipe: Ductile iron pipe meeting AWWA C-150, C-151 and ANSI A21-50 and A 21.15 for coated outside and cement lined inside. Cement lining according to AWWA C104, Class 350.

2. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.
3. Compact Fittings: AWWA C153, for push-on joints.
4. Gaskets: AWWA C111, rubber.

B. PE Encasement for Ductile-Iron Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch (0.20-mm) minimum thickness, tube or sheet.

C. Identification for Underground Plastic Pipe:

1. Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid yellow in color with continuously printed caption in red letters "CAUTION - SANITARY SEWER LINE BURIED BELOW."

2.3 CLEANOUTS:

A. General: Provide Mission adjustable repair coupling (or approved equal) with stainless steel bends and stainless-steel shear ring and a Zurn #ZN1400HD-3, Smith 4220 (or approved equal) cover set flush in a minimum 14" square concrete slab.

2.4 IDENTIFICATION:

A. Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid green in color with continuously printed caption in black letters "CAUTION - SEWER LINE BURIED BELOW."

PART 3 - EXECUTION

3.1 PREPARATION OF FOUNDATION FOR BURIED SANITARY SEWERAGE SYSTEMS:

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid, and backfill according to provisions in Section 31 2000 – Earth Moving.

C. Shape bottom of trench to fit bottom of pipe. Fill unevenness with tamped sand backfill. Dig bell holes at each pipe joint to relieve the bells of all loads and to ensure continuous bearing of the pipe barrel on the foundation.

3.2 PIPE APPLICATIONS FOR UNDERGROUND SANITARY SEWERS:

A. Refer to Paragraph 2.2 above.

3.3 INSTALLATION, GENERAL:

A. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of the underground sanitary sewerage system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

C. Use fittings for changes in direction. Use fittings for branch connections, except where direct tap into existing sewer is indicated.

D. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

E. Install piping pitched down in direction of flow, at minimum slope of 1 percent, except where indicated otherwise.

F. Extend sanitary sewerage system piping to connect to building sanitary drains, of sizes and in locations indicated.

G. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed, by tunneling, jacking, or a combination of both.

3.4 PIPE JOINT CONSTRUCTION AND INSTALLATION:

A. Join and install ductile iron pipe per ALDOT Standard Specifications.

3.5 CLEANOUTS:

A. Install cleanouts and extension from sewer pipe to cleanout at grade as indicated. Set cleanout lid in concrete block 14 by 14 by 12 inches deep, except where location is in concrete paving. Set top of cleanout 1 inch above surrounding earth grade or flush with grade when installed in paving.

3.6 TAP CONNECTIONS:

A. Make connections to existing piping and underground structures so that finished work will conform as nearly as practicable to the requirements specified for new work.

B. When tapping into existing man holes, use flexible rubber boot in accordance with authority having jurisdiction's requirements.

C. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap, with not less than 6 inches of 3000-psi 28-day compressive-strength concrete.

D. Make branch connections from side into existing 4- to 21-inch piping by removing section of existing pipe and installing wye fitting, into existing piping. Encase entire wye with not less than 6 inches of 3000-psi 28-day compressive-strength concrete.

1. Provide concrete that will attain minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
2. Use epoxy bonding compound as interface between new and existing concrete and piping materials.

E. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris, concrete, or other extraneous material that may accumulate.

3.7 INSTALLATION OF IDENTIFICATION:

A. Install continuous plastic underground warning tape during back-filling of trench for underground water service piping. Locate 6 to 8 inches below finished grade, directly over piping.

3.8 FIELD QUALITY CONTROL:

A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction.

B. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.
2. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.
3. Flush piping between manholes, if required by local authority, to remove collected debris.

C. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.

1. Make inspections after pipe between manholes and manhole locations has been installed and approximately 2 feet of backfill is in place, and again at completion of project.
2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects correct such defects, and reinspect.

END OF SANITARY SEWERAGE UTILITIES

SECTION 33 4001

STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Related work specified elsewhere includes:

.. Section 31 2000 - "Earth Moving"
.. Section 03 3000 - "Cast-In-Place Concrete"

1.2 DESCRIPTION OF WORK:

A. Work described in this section includes the construction of new storm drainage pipe and structures as shown on the Drawings

1.3 QUALITY CONTROL:

A. Certifications: The Contractor shall submit to the Architect copies of certificates from suppliers of pipe, gaskets, reinforcing steel, cast iron downspout boots, cast iron frames, covers and grates, ready-mix concrete and other manufactured items, certifying that these products comply with the specifications and standards listed hereinafter.

B. Standard Specifications: Unless otherwise noted, all specifications referred to shall be the Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction, 2014 Edition or most current edition.

C. Testing: All laboratory and field testing as required to ensure compliance with these specifications will be performed by an independent testing laboratory.

D. Comply with requirements of the International Plumbing Code, the American Concrete Pipe Association, and authorities having jurisdiction, when more stringent than specified or otherwise indicated

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Where indicated, pipe smaller than 12-inches in diameter shall be Schedule 80 PVC, Contech A2000 PVC (or approved equal), or ADS N-12 HP HDPE, unless otherwise indicated on the drawings.

1. Where indicated on the Drawings for "french drain" or "perforated underdrain", pipe shall be equivalent to ADS N-12 (perforated) corrugated HDPE pipe with smooth interior or perforated Contech A2000 PVC, complete with filter fabric "sock" and all required or necessary system accessories, fittings, and components, as specified in Article 853.13.

B. Pipe larger than 12-inches (or equivalent area in arch pipe) shall be Class 3, minimum reinforced concrete pipe (RCP) as specified in Article 850, or as indicated on the Drawings.

C. Concrete and reinforcing steel for headwalls, inlets, manholes, and other storm drainage structures shall comply with Alabama Department of Transportation Specification Section 501, and Section 502. Concrete shall be Class "A", Type 2 (3,000 psi).

D. Masonry materials and precast concrete units shall conform to Article 621.02.

E. Castings for frames, covers and grates in drainage structures shall comply with ALDOT Section 836, with particular attention directed to ALDOT Article 836.04, 836.05, 836.06, and 836.07.

1. All manhole covers shall be round.

F. Identification for Underground Plastic Pipe:

1. Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid yellow in color with continuously printed caption in black letters "CAUTION – STORM SEWER LINE BURIED BELOW."

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allen Systems, Inc.; Reef Industries, Inc.
b. Brady (W.H.) Co.; Signmark Div.
c. Calpico, Inc.
d. Carlton Industries, Inc.
e. EMED Co., Inc.
f. Seton Name Plate Co.

PART 3 - EXECUTION

3.1 STORM DRAIN PIPE:

A. Construction requirements, including excavation of trench, placing pipe, and backfilling around pipe shall conform to the applicable portions of Article 530.03 of the Alabama Department of Transportation specifications.

B. Bedding for storm pipe shall be as shown on the Drawings and as per the pipe manufacturer's requirements, Type 3 or better installation. Open graded stone, such as #57 stone, is not allowed as backfill.

C. Compaction requirements for backfill shall be the same as specified for type of surface constructed over the trench, paved or planted areas as described in Section 31 2000 - "Earth Moving."

D. Properly coordinate with elevations of grades, footings, other below grade work, and etc.

3.2 INSTALLATION OF IDENTIFICATION:

A. Install continuous plastic underground warning tape during back-filling of trench for underground water service piping. Locate 6 to 8 inches below finished grade, directly over piping.

3.3 STRUCTURES:

A. Inlets, manholes, cleanouts and other storm drainage structures shall be installed or constructed in accordance with applicable portions of the following sections of the Alabama Highway Department Standard Specifications:

1. Section 501 - Structural Portland Cement Concrete.
2. Section 502 - Steel Reinforcement.
3. Section 613 - Brick and Concrete Block Masonry.
4. Section 620 - Minor Structure Concrete.
5. Section 621 - Inlets, Junction Boxes, Manholes and Miscellaneous Drainage Structures.
6. Section 622 - Resetting Gratings and Covers and for Catch Basins, Inlets, and Manholes.

END OF STORM DRAINAGE

PROJECT MANUAL

HOUSTON COUNTY
DEPARTMENT OF HUMAN RESOURCES

Dothan, Alabama

for

Houston County Public Building Authority
(Local Funds)

ISSUED FOR BID

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GMC PROJECT NUMBER: ABHM250019

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26 0526 - GROUNDING
26 0533 - RACEWAYS
26 0534 - OUTLET BOXES, JUNCTION BOXES, WIREWAYS
26 0536 - CABLE TRAYS
26 0553 - ELECTRICAL IDENTIFICATION
26 0943 - LIGHTING CONTROL SYSTEM
26 2416 - POWER PANELBOARDS-CIRCUIT BREAKER TYPE
26 2417 - LIGHTING PANELBOARDS
26 2726 - WIRING DEVICES
26 2816 - SAFETY SWITCHES AND FUSES
26 4100 - LIGHTNING PROTECTION SYSTEM
26 4300 - SURGE PROTECTIVE DEVICES
26 5000 - LIGHTING MATERIALS AND METHODS

DIVISION 27 -- COMMUNICATIONS

27 0500 - AUXILIARY SYSTEM CABLES, 0-50V
27 1000 - STRUCTURED CABLING SYSTEM
27 4100 - TELEVISION DISTRIBUTION SYSTEM

DIVISION 28 -- ELECTRONIC SAFETY AND SECURITY

28 0723 - SECURITY MANAGEMENT SYSTEM
28 2000 - CCTV SURVEILLANCE SYSTEM - IP
28 3100 - FIRE ALARM SYSTEM
28 7800 - EMERGENCY RESPONDER RADIO COVERAGE SYSTEM

DIVISION 31 -- EARTHWORK

CIVIL SEAL SHEET
31 1000 - SITE CLEARING

31 2000 - EARTH MOVING
31 2500 - EROSION AND SEDIMENTATION CONTROL
31 3116 - TERMITE CONTROL

DIVISION 32 -- EXTERIOR IMPROVEMENTS

LANDSCAPE SEAL SHEET
32 1216 - ASPHALT PAVING
32 1313 - CONCRETE PAVING
32 1613 - CURBS AND GUTTERS
32 1723 - PAVEMENT MARKINGS
32 1816.23 - EPDM/TPV PLAYGROUND PROTECTIVE SURFACING
32 3300 - SITE FURNISHINGS
32 8420 - UNDERGROUND IRRIGATION
32 9000 - LANDSCAPE WORK
32 9700 - LANDSCAPE MAINTENANCE

DIVISION 33 -- UTILITIES

33 1000 - WATER UTILITIES
33 3000 - SANITARY SEWERAGE UTILITIES
33 4001 - STORM DRAINAGE

APPENDICES

APPENDIX 1 - REPORT OF GEOTECHNICAL EXPLORATION

END OF TABLE OF CONTENTS

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ADVERTISEMENT FOR PREQUALIFICATION AND BIDS

PREQUALIFICATION PROPOSALS will be received via email, or other electronic transmission, on behalf of the Owner by Goodwyn Mills Cawood, LLC., at 2400 5th Avenue South, Ste. 200, Birmingham, AL 35233, for the below referenced project, until **2:00 PM Local Time, April 21, 2026.** The prequalification procedure is intended to identify responsible and competent bidders relative to the requirements of the Project. Prequalification proposal requirements may be obtained from the Architect, by request by e-mail alyssa.martin@gmcnetwork.com, to Alyssa Martin. Additional qualifications and requirements for General Contractor Bidders and separate Subcontractors are indicated in the Bid and Contract Documents.

SEALED PROPOSALS will be received only from previously PRE-QUALIFIED General Contractors by Houston County Public Building Authority, located at 462 N Oates Street, Dothan, AL 36303, Ground Floor, Commission Chambers; until 2:00 PM Local Time, May 21, 2026 for this project:

HOUSTON COUNTY DEPARTMENT OF HUMAN RESOURCES
Dothan, ALABAMA for
Houston County Public Building Authority

(LOCALLY FUNDED)

at which time and place they will be publicly opened and read.

A cashiers check or bid bond payable to Houston County Public Building Authority in an amount not less than five (5) percent of the amount of the bid, but in no event more than $10,000, must accompany the bidder's proposal. Performance and statutory Labor and Material Payment Bonds, and insurance in compliance with requirements, will be required at the signing of the Contract.

Drawings and Specifications may be examined at the Office of the Architect; Dodge Data & Analytics; Data Fax; and ConstructConnect.

Bid documents (Plans, Specifications, and Addenda) will be sent to prequalified General Contractors only from the Architect electronically with no deposit. Subcontractors should contact a General Contractor or plan room for documents.

Only General Contractors who have completed the prequalification process within the stated time limits, and which are properly licensed in accordance with criteria established by the State Licensing Board for General Contractors under the Provision of Title 34, Chapter 8, Code of Alabama, 1975, as amended, will be considered for prequalification for the Work of this project.

A **MANDATORY PRE-BID CONFERENCE** will be held at the same location as bids are to be opened, at **2:00 PM local time May 7, 2026** for the purpose of reviewing the project and answering Bidder's questions. **Attendance at the Pre-Bid Conference IS REQUIRED for all General Contractor Bidders** intending to submit a Proposal, and is highly recommended for Subcontractors. Bids from General Contractors not attending the Pre-Bid Conference will be rejected.

Per the Owner and the Alabama Department of Revenue (ADOR), Act 2013-205, the project will be bid **EXCLUDING TAXES** and will require the Contractor to complete DCM Form C-3A Accounting of Sales Tax Attachment to DCM Form C-3 Proposal Form (August 2020) which will be submitted with the Contractors Proposal at the time of the Bid. If awarded the bid, both tax exempt entity and contractor shall apply for certificates of exemption. ADOR shall issue certificates of exemption from

sales and use tax for each tax exempt project. Certificates shall only be issued to contractors licensed by the State Licensing Board for General Contractors or any subcontractor working under the same contract. Items eligible for exemption are building materials, construction materials and supplies and other tangibles that become part of the structure. ADOR will handle the administration of the certificates and the accounting of exempt purchases.

The Owner reserves the right to reject any or all proposals, to waive technical errors and/or abandon the prequalification and bid process if, in their judgment, the best interests of the Owner will thereby be promoted.

Houston County Public Building Authority
462 N Oates Street
Dothan, AL 36303

GOODWYN MILLS CAWOOD, LLC.
MEMBERS, AMERICAN INSTITUTE OF ARCHITECTS
2400 5th Avenue South, Suite 200
Birmingham, Alabama 35233
Phone: (205) 879-4462
Fax: (205) 879-4493

****

END OF ADVERTISEMENT

NOTE: For projects exceeding $50,000, this notice must be run once a week for three successive weeks in a newspaper of general circulation in the county or counties in which the project, or any part of the project, is to be performed. If the project involves an estimated amount exceeding $500,000, this notice must also be run at least once in three newspapers of general circulation throughout the state. Proof of publication is required.

DCM Form C-1; August 2020.
REVISED (GM&C): February 2021.

DRAFT AIA® Document A305® – 2020
Exhibit A

General Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by « » and dated the « » day of « » in the year « »
(In words, indicate day, month and year.)

§ A.1 ORGANIZATION
§ A.1.1 Name and Location
§ A.1.1.1 Identify the full legal name of your organization.

« »

§ A.1.1.2 List all other names under which your organization currently does business and, for each name, identify jurisdictions in which it is registered to do business under that trade name.

« »

§ A.1.1.3 List all prior names under which your organization has operated and, for each name, indicate the date range and jurisdiction in which it was used.

« »

§ A.1.1.4 Identify the address of your organization's principal place of business and list all office locations out of which your organization conducts business. If your organization has multiple offices, you may attach an exhibit or refer to a website.

« »

§ A.1.2 Legal Status
§ A.1.2.1 Identify the legal status under which your organization does business, such as sole proprietorship, partnership, corporation, limited liability corporation, joint venture, or other.

« »

.1 If your organization is a corporation, identify the state in which it is incorporated, the date of incorporation, and its four highest-ranking corporate officers and their titles, as applicable.

« »

.2 If your organization is a partnership, identify its partners and its date of organization.

« »

.3 If your organization is individually owned, identify its owner and date of organization.

« »

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.4 If the form of your organization is other than those listed above, describe it and identify its individual leaders:

« »

§ A.1.2.2 Does your organization own, in whole or in part, any other construction-related businesses? If so, identify and describe those businesses and specify percentage of ownership.

« »

§ A.1.3 Other Information

§ A.1.3.1 How many years has your organization been in business?

« »

§ A.1.3.2 How many full-time employees work for your organization?

« »

§ A.1.3.3 List your North American Industry Classification System (NAICS) codes and titles. Specify which is your primary NAICS code.

« »

§ A.1.3.4 Indicate whether your organization is certified as a governmentally recognized special business class, such as a minority business enterprise, woman business enterprise, service disabled veteran owned small business, woman owned small business, small business in a HUBZone, or a small disadvantaged business in the 8(a) Business Development Program. For each, identify the certifying authority and indicate jurisdictions to which such certification applies.

« »

§ A.2 EXPERIENCE

§ A.2.1 Complete Exhibit D to describe up to four projects, either completed or in progress, that are representative of your organization's experience and capabilities.

§ A.2.2 State your organization's total dollar value of work currently under contract.

« »

§ A.2.3 Of the amount stated in Section A.2.2, state the dollar value of work that remains to be completed:

« »

§ A.2.4 State your organization's average annual dollar value of construction work performed during the last five years.

« »

§ A.3 CAPABILITIES

§ A.3.1 List the categories of work that your organization typically self-performs.

« »

§ A.3.2 Identify qualities, accreditations, services, skills, or personnel that you believe differentiate your organization from others.

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« »

§ A.3.3 Does your organization provide design collaboration or pre-construction services? If so, describe those services.

« »

§ A.3.4 Does your organization use building information modeling (BIM)? If so, describe how your organization uses BIM and identify BIM software that your organization regularly uses.

« »

§ A.3.5 Does your organization use a project management information system? If so, identify that system.

« »

§ A.4 REFERENCES

§ A.4.1 Identify three client references:
(Insert name, organization, and contact information)

« »

§ A.4.2 Identify three architect references:
(Insert name, organization, and contact information)

« »

§ A.4.3 Identify one bank reference:
(Insert name, organization, and contact information)

« »

§ A.4.4 Identify three subcontractor or other trade references:
(Insert name, organization, and contact information)

« »

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Exhibit B

Financial and Performance Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by « » and dated the « » day of « » in the year « »
(In words, indicate day, month and year.)

§ B.1 FINANCIAL
§ B.1.1 Federal tax identification number:

« »

§ B.1.2 Attach financial statements for the last three years prepared in accordance with Generally Accepted Accounting Principles, including your organization's latest balance sheet and income statement. Also, indicate the name and contact information of the firm that prepared each financial statement.

« »

§ B.1.3 Has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, been the subject of any bankruptcy proceeding within the last ten years?

« »

§ B.1.4 Identify your organization's preferred credit rating agency and identification information.
(Identify rating agency, such as Dun and Bradstreet or Equifax, and insert your organization's identification number or other method of searching your organization's credit rating with such agency.)

« »

§ B.2 DISPUTES AND DISCIPLINARY ACTIONS
§ B.2.1 Are there any pending or outstanding judgments, arbitration proceedings, bond claims, or lawsuits against your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, or any of the individuals listed in Exhibit A, Section 1.2, in which the amount in dispute is more than $75,000?
(If the answer is yes, provide an explanation.)

« »

§ B.2.2 In the last five years has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management:
(If the answer to any of the questions below is yes, provide an explanation.)

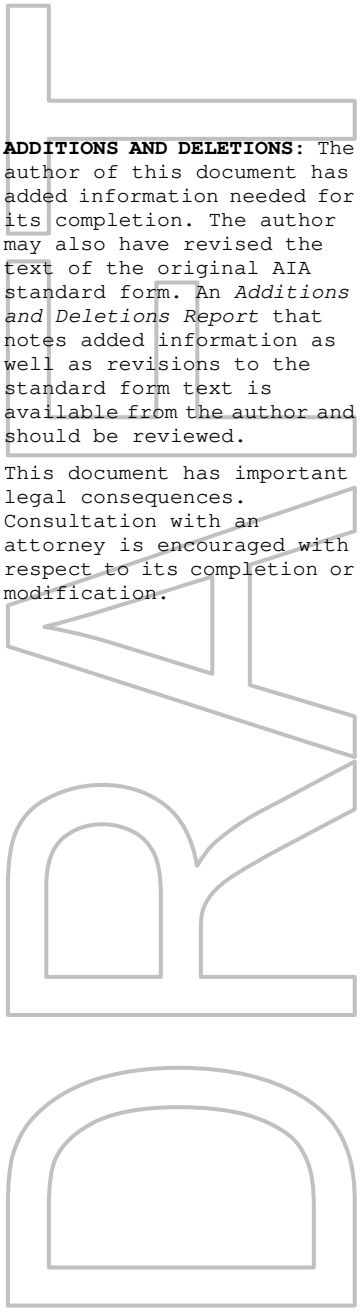
.1 failed to complete work awarded to it?

« »

.2 been terminated for any reason except for an owners' convenience?

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« »

.3 had any judgments, settlements, or awards pertaining to a construction project in which your organization was responsible for more than $75,000?

« »

.4 filed any lawsuits or requested arbitration regarding a construction project?

« »

§ B.2.3 In the last five years, has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management; or any of the individuals listed in Exhibit A Section 1.2:
(If the answer to any of the questions below is yes, provide an explanation.)

.1 been convicted of, or indicted for, a business-related crime?

« »

.2 had any business or professional license subjected to disciplinary action?

« »

.3 been penalized or fined by a state or federal environmental agency?

« »

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Exhibit C

Project Specific Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by « » and dated the « » day of « » in the year « »
(In words, indicate day, month and year.)

PROJECT:
(Name and location or address.)

« »
« »

CONTRACTOR'S PROJECT OFFICE:
(Identify the office out of which the contractor proposes to perform the work for the Project.)

« »

TYPE OF WORK SOUGHT
(Indicate the type of work you are seeking for this Project, such as general contracting, construction manager as constructor, design-build, HVAC subcontracting, electrical subcontracting, plumbing subcontracting, etc.)

« »

CONFLICT OF INTEREST
Describe any conflict of interest your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, or any of the individuals listed in Exhibit A Section 1.2, may have regarding this Project.

« »

§ C.1 PERFORMANCE OF THE WORK
§ C.1.1 When was the Contractor's Project Office established?

« »

§ C.1.2 How many full-time field and office staff are respectively employed at the Contractor's Project Office?

« »

§ C.1.3 List the business license and contractor license or registration numbers for the Contractor's Project Office that pertain to the Project.

« »

§ C.1.4 Identify key personnel from your organization who will be meaningfully involved with work on this Project and indicate (1) their position on the Project team, (2) their office location, (3) their expertise and experience, and (4) projects similar to the Project on which they have worked.

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« »

§ C.1.5 Identify portions of work that you intend to self-perform on this Project.

« »

§ C.1.6 To the extent known, list the subcontractors you intend to use for major portions of work on the Project.

« »

§ C.2 EXPERIENCE RELATED TO THE PROJECT

§ C.2.1 Complete Exhibit D to describe up to four projects performed by the Contractor's Project Office, either completed or in progress, that are relevant to this Project, such as projects in a similar geographic area or of similar project type. If you have already completed Exhibit D, but want to provide further examples of projects that are relevant to this Project, you may complete Exhibit E.

§ C.2.2 State the total dollar value of work currently under contract at the Contractor's Project Office:

« »

§ C.2.3 Of the amount stated in Section C.2.2, state the dollar value of work that remains to be completed:

« »

§ C.2.4 State the average annual dollar value of construction work performed by the Contractor's Project Office during the last five years.

« »

§ C.2.5 List the total number of projects the Contractor's Project Office has completed in the last five years and state the dollar value of the largest contract the Contractor's Project Office has completed during that time.

« »

§ C.3 SAFETY PROGRAM AND RECORD

§ C.3.1 Does the Contractor's Project Office have a written safety program?

« »

§ C.3.2 List all safety-related citations and penalties the Contractor's Project Office has received in the last three years.

« »

§ C.3.3 Attach the Contractor's Project Office's OSHA 300a Summary of Work-Related Injuries and Illnesses form for the last three years.

§ C.3.4 Attach a copy of your insurance agent's verification letter for your organization's current workers' compensation experience modification rate and rates for the last three years.

§ C.4 INSURANCE

§ C.4.1 Attach current certificates of insurance for your commercial general liability policy, umbrella insurance policy, and professional liability insurance policy, if any. Identify deductibles or self-insured retentions for your commercial general liability policy.

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§ C.4.2 If requested, will your organization be able to provide property insurance for the Project written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis?

« »

§ C.4.3 Does your commercial general liability policy contain any exclusions or restrictions of coverage that are prohibited in AIA Document A101-2017, Exhibit A, Insurance A.3.2.2.2? If so, identify.

« »

§ C.5 SURETY

§ C.5.1 If requested, will your organization be able to provide a performance and payment bond for this Project?

« »

§ C.5.2 Surety company name:

« »

§ C.5.3 Surety agent name and contact information:

« »

§ C.5.4 Total bonding capacity:

« »

§ C.5.5 Available bonding capacity as of the date of this qualification statement:

« »

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DRAFT AIA® Document A305® – 2020

Exhibit D

Contractor's Past Project Experience

	1	2	3	4
PROJECT NAME				
PROJECT LOCATION				
PROJECT TYPE				
OWNER				
ARCHITECT				
CONTRACTOR'S PROJECT EXECUTIVE				
KEY PERSONNEL (include titles)				
PROJECT DETAILS	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work
PROJECT DELIVERY METHOD	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☑ CM advisor ☐ Other:
SUSTAINABILITY CERTIFICATIONS				

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DRAFT AIA® Document A305® – 2020

Exhibit E

Contractor's Past Project Experience, Continued

	1	2	3	4
PROJECT NAME				
PROJECT LOCATION				
PROJECT TYPE				
OWNER				
ARCHITECT				
CONTRACTOR'S PROJECT EXECUTIVE				
KEY PERSONNEL (include titles)				
PROJECT DETAILS	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work
PROJECT DELIVERY METHOD	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☑ CM advisor ☐ Other:
SUSTAINABILITY CERTIFICATIONS				

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AIA® Document A701™ – 2018

Instructions to Bidders

for the following Project:
(Name, location, and detailed description)

THE OWNER:
(Name, legal status, address, and other information)

THE ARCHITECT:
(Name, legal status, address, and other information)

TABLE OF ARTICLES

1 DEFINITIONS

2 BIDDER'S REPRESENTATIONS

3 BIDDING DOCUMENTS

4 BIDDING PROCEDURES

5 CONSIDERATION OF BIDS

6 POST-BID INFORMATION

7 PERFORMANCE BOND AND PAYMENT BOND

8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

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It is intended that AIA Document G612™–2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

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ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents, to which Work may be added or deleted by sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from, or that does not change, the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 By submitting a Bid, the Bidder represents that:

.1 the Bidder has read and understands the Bidding Documents;

.2 the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;

.3 the Bid complies with the Bidding Documents;

.4 the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;

.5 the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and

.6 the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

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§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

§ 3.1.3 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the advertisement or invitation to bid, or in supplementary instructions to bidders.

§ 3.1.4 Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

§ 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3 Substitutions

§ 3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

§ 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

§ 3.3.2.2 Bidders shall submit substitution requests on a Substitution Request Form if one is provided in the Bidding Documents.

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

§ 3.3.3 The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.4 If the Architect approves a proposed substitution prior to receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding, and Bidders shall not rely upon them.

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§ 3.3.5 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

§ 4.1.1 Bids shall be submitted on the forms included with or identified in the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed. Paper bid forms shall be executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper bid forms must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change" or as required by the bid form.

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall neither make additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to bind the Bidder.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Bid.

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

(Insert the form and amount of bid security.)

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

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§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning days after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:
(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

§ 4.3.2 Paper copies of the Bid, the bid security, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address, and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

§ 4.3.4 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.5 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

§ 4.4 Modification or Withdrawal of Bid

§ 4.4.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:
(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

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§ 5.2 Rejection of Bids

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

§ 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

§ 5.3.2 Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

§ 6.2 Owner's Financial Capability

A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 Submittals

§ 6.3.1 After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

.1 a designation of the Work to be performed with the Bidder's own forces;

.2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and

.3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

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§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.
(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

§ 7.2 Time of Delivery and Form of Bonds
§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix to the bond a certified and current copy of the power of attorney.

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS
§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013.)

.5 Drawings

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Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda:

Number	Date	Pages

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[ ] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017.)

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents listed below:
(List here any additional documents that are intended to form part of the Proposed Contract Documents.)

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Additions and Deletions Report for

AIA® Document A701™ – 2018

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 13:51:45 ET on 05/23/2019.

There are no differences.

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Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 13:51:45 ET on 05/23/2019 under Order No. 1831144354 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A701™ – 2018, Instructions to Bidders , as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

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STATE OF ALABAMA
BUILDING COMMISSION
770 WASHINGTON AVE
SUITE 444
Montgomery, Alabama 36130-1150
Telephone: (334) 242-4082
Fax: (334) 242-4182

ROBERT BENTLEY
Governor

Katherine Lynn
Director

October 28, 2013

TO: **STATE AGENCIES, K-12 SUPERINTENDENTS, COMMUNITY COLLEGES, UNIVERSITIES**

FROM: **KATHERINE LYNN, DIRECTOR**
ALABAMA BUILDING COMMISSION

SUBJECT: **ACT 2013-205, CERTIFICATE OF EXEMPTION FROM SALES AND USE TAX FOR GOVERNMENTAL ENTITIES**

Act 2013-205 was signed into law on May 9, 2013, granting the Alabama Department of Revenue (ADOR) the authority to issue certificates of exemption from sales and use taxes for construction projects for certain governmental agencies.

Summary

The full text of Act 2013-205 is available on the Building Commission's website at www.bc.alabama.gov. A brief summary of the Act is provided below:

- ADOR shall issue certificates of exemption from sales and use tax to governmental entities for each tax exempt project. Both the governmental entity and the contractor shall apply for certificates of exemption.
- Certificates of exemption shall only be issued for contracts entered into (awarded) on or after Jan. 1, 2014.
- Certificates shall only be issued to contractors licensed by the State Licensing Board for General Contractors or any subcontractor working under the same contract.
- Items eligible for exemption from sales and use tax are building materials, construction materials and supplies and other tangible personal property that become part of the structure per the written construction contract.
- ADOR will handle the administration of certificates of exemption and the accounting of exempt purchases. ADOR will have the ability to levy fines and may bar the issuance or use of certificates of exemption upon determination of willful misuse by the contractor or a subcontractor.
- The contractor shall account for the tax savings on the bid form.

Bidding of Projects Before Jan. 1, 2014

Projects bid before Jan 1, 2014 but awarded on or after Jan. 1, 2014 are still eligible for sales tax exemption regardless of whether the project was bid with or without sales tax. For projects bid before Jan. 1, 2014, the bid documents must specify if the contractor's bid shall or shall not include sales tax.

For projects bid before Jan. 1, 2014, if the project is bid with sales tax and the contractor and subcontractors purchase the materials tax exempt, prior to project closeout the contractor shall submit to the governmental entity a copy of the report filed with the Alabama Department of Revenue showing all exempt purchases. The actual sales tax savings indicated on the report shall be deducted from the final contract amount.

For projects bid after Jan. 1, 2014, the bid shall not include sales tax but the sales tax for the base bid and all bid items must be included on the contractor's bid proposal form. ABC Form C-3A indicates how the sales tax shall be accounted for on the bid proposal form and shall be modified by the project architect or engineer as appropriate for the bid items for each project. **Failure of the contractor to complete the attachment to the bid proposal form indicating the sales tax as required by Act 2013-205, Section 1 (g) shall render the bid non-responsive.**

Proposed Changes to Administrative Rules

Pursuant to Act 2013-205, the ADOR has proposed changes to the following administrative rules:

Rule 810-6-1-.46	Contractor's Liability
Rule 810-6-1-.46.01	Bleacher Systems, Lockers, Backstops, and Other Fixtures Installed in Gymnasiums
Rule 810-6-3-.77	Exemption for Certain Purchases by Contractors and Subcontractors in Conjunction with Construction Contracts with Certain Governmental Entities

A link to the proposed rules and information about the public hearings can be found on ADOR's website at http://www.revenue.alabama.gov/analysis/upcoming-rule-hearings.cfm . All interested parties may present their views in writing to the **Secretary of the Alabama Department of Revenue, Room 4131, Gordon Persons Building, 50 N Ripley Street, Montgomery, Alabama 36132** at any time during the thirty-five (35) day period following publication of the notice or by appearing at the hearing.

If you have any questions, please feel free to contact Katherine Lynn at the Alabama Building Commission at (334) 242-4082 or the Alabama Department of Revenue at (334) 242-1170.

cc: Ms. Julie Magee, Commissioner, Alabama Department of Revenue
Mr. Ben Albritton, Assistant Attorney General

PROPOSAL FORM

To: HOUSTON COUNTY PUBLIC BUILDING AUTHORITY **Date:**_____
(Awarding Authority)

In compliance with your Advertisement for Bids and subject to all the conditions thereof, the undersigned,

_____

(Legal Name of Bidder)

hereby proposes to furnish all labor and materials and perform all work required for the construction of **WORK:** HOUSTON COUNTY DEPARTMENT OF HUMAN RESOURCES, Dothan, Alabama, for HOUSTON PUBLIC BUILDING AUTHORITY in accordance with Drawings and Specifications, dated November 14, 2025, prepared by GOODWYN MILLS CAWOOD, LLC. (Architect's Project No. ABHM250019__), Architect/Engineer.

The Bidder, which is organized and existing under the laws of the State of _____,

having its principal offices in the City of _____,

is: ☐ a Corporation ☐ a Partnership ☐ an Individual ☐ (other) _____.

LISTING OF PARTNERS OR OFFICERS: If Bidder is a Partnership, list all partners and their addresses; if Bidder is a Corporation, list the names, titles, and business addresses of its officers:

_____

_____

_____

_____

_____

BIDDER'S REPRESENTATION: The Bidder declares that it has examined the site of the Work, having become fully informed regarding all pertinent conditions, and that it has examined the Drawings and Specifications (including all Addenda received) for the Work and the other Bid and Contract Documents relative thereto, and that it has satisfied itself relative to the Work to be performed.

ADDENDA: The Bidder acknowledges receipt of Addenda No's. _____ through _____ inclusively.

BASE BID: For construction complete as shown and specified, the sum of:

_____ Dollars ($_____)

ALTERNATES: **NONE**

ALLOWANCES: Refer to Section 01 2100 – "Allowances", and Drawings for descriptions and requirements.
(Allowance Calculations DUE along with Proposal Form on Bid Date.)

COMPLETION DATE: All Base Bid and any Alternate Work in the Contract shall be "Substantially Complete" within 480 consecutive days, from the date of the Owner's written "Notice To Proceed".

UNIT PRICES: Refer to "Attachment A to Proposal Form"
(Attachment A to Proposal Form DUE along with Proposal Form on Bid Date).

MAJOR SUBCONTRACTOR & SUPPLIER LISTING: Refer to "Attachment B to Proposal Form"
(DUE along with Proposal Form on Bid Date, or at Contractor's option, turned in to the Owner within 24-hours after receipt of Bids, with a copy to the Architect).

NOTE THAT ALL SUBCONTRACTORS AND SUPPLIERS ARE SUBJECT TO APPROVAL BY THE OWNER.

ACCOUNTING OF SALES TAX: Refer to "Attachment C to Proposal Form".
(DUE along with Proposal Form on Bid Date).

CHANGES IN WORK: Changes in the Work shall be addressed as described in General Conditions Article on Changes in the Work (and as modified by Supplementary Conditions).

IMMIGRATION STATUS VERIFICATION: Refer to "General Conditions" portion of the Project Manual.
(DUE along with Proposal Form on Bid Date.)

1. Executed E-VERIFY "Memorandum of Understanding".

BID SECURITY: The undersigned agrees to enter into a Construction Contract and furnish the prescribed Performance and Payment Bonds and evidence of insurance within fifteen calendar days, or such other period stated in the Bid Documents, after the contract forms have been presented for signature, provided such presentation is made within 60 calendar days after the opening of bids, or such other period stated in the Bid Documents. As security for this condition, the undersigned further agrees that the funds represented by the Bid Bond (or cashier's check) attached hereto may be called and paid into the account of the Awarding Authority as liquidated damages for failure to so comply.

Attached hereto is a: *(Mark the appropriate box and provide the applicable information.)*

☐ Bid Bond, executed by _____ as Surety,

☐ a cashier's check on the _____ Bank of _____,

for the sum of _____ Dollars

($_____) made payable to the Awarding Authority.

BIDDER'S ALABAMA LICENSE:

State License for General Contracting: _____
License Number Contractor's DUNS No. Bid Limit

_____
Type(s) of Work

CERTIFICATIONS: The undersigned certifies that he or she is authorized to execute contracts on behalf of the Bidder as legally named, that this proposal is submitted in good faith without fraud or collusion with any other bidder, that the information indicated in this document is true and complete, and that the bid is made in full accord with State law. Notice of acceptance may be sent to the undersigned at the address set forth below.

The Bidder also declares that a list of all proposed major subcontractors and suppliers is included and attached to the Proposal Form, or will be turned in to the Owner within twenty-four (24) hours after receipt of bids, with a copy to the Architect.

Bidder certifies that vendors, subcontractors and affiliates, that make sales for delivery into Alabama or leases for use in Alabama are registered, collecting, and remitting Alabama state and local sales, use, and /or lease tax on all taxable sales and leases into Alabama. By submitting a proposal, contractor is hereby certifying that he and his company are in full compliance with Act No. 2006-557, and not barred from bidding or entering into a contract pursuant to 41-4-116 (Code of Alabama 1975), and acknowledge that the awarding authority may declare the contract void if the certification is false.

Legal Name of Bidder _____

Mailing Address _____

*** By (Legal Signature)** _____

* Name (type or print) _____ *(Seal)*

* Title _____

Telephone Number _____

* If other than the individual proprietor, or an above named member of the Partnership, or the above named president, vice-president, or secretary of the Corporation, attach written authority to bind the Bidder. Any modification to a bid shall be over the initials of the person signing the bid, or of an authorized representative.

END OF PROPOSAL FORM

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_____

CONTRACTOR

ATTACHMENT A

TO PROPOSAL FORM

1.1 UNIT PRICES:

A. The undersigned proposes the following Unit Prices for additions to or deductions from the Work wherein Unit Prices are applicable as determined by the Architect and Owner. These Unit Prices include all charges for labor and materials, fee, layout, supervision (field and home office), general expenses, taxes, insurance, overhead and profit, for Unit Item of Work in place. The Contract sum shall be increased or decreased based upon quantity difference multiplied by the applicable Unit Price, in accordance with the General Conditions.

B. Refer to Section 01 2200 - "Unit Prices", and to the respective sections of the Specifications for the complete Unit Price Item description.

C. Submit the following Unit Prices with the Proposal Form on Bid Date.

	ITEM DESCRIPTION:	UNIT:*	UNIT PRICE:
1.	Sod	SY	$ _____
2.	Concrete Mud Footings	CY	$ _____
3.	Undercut in Building Control Areas	CY	$ _____
4.	Undercut in Non-Building Control Areas	CY	$ _____
5.	Concrete Sidewalk	SF	$ _____
6.	Chain Link Fence	LF	$ _____
7.	Gypsum Board Ceiling	SF	$_____
8.	Building Canopy	SF	$_____
9.	Walkway Canopy	SF	$_____
10.	Luxury Vinyl Tile (LVT)	SF	$_____
11.	ACT-1 Ceiling Tile and Grid	SF	$_____
12.	ACT02 Ceiling Tile and Grid	SF	$_____
13.	Stamped Concrete	SF	$_____

14.	57 Stone	TN	$_____
15.	Access Control	EA	$_____
16.	Panic Device	EA	$_____
17.	Geotextile Fabric	SY	$_____
18.	Dense Grade Base	TN	$_____

(*) Legend to "unit" quantity abbreviations:

CY	Per "Cubic Yard"
SY	Per "Square Yard"
TN	Per "Ton"
SF	Per "Square Foot"
LF	Per "Linear Foot"

END OF ATTACHMENT A TO PROPOSAL FORM

_____
CONTRACTOR

ATTACHMENT "B"

TO PROPOSAL FORM

1.1 SUBCONTRACTORS LISTING:

A. Submit the following Subcontractors names with the Proposal Form by 2:00 PM local time on Bid Date, OR at Contractor's option, turned in to the Owner within 24-hours after the time scheduled for the opening of Bids, with a copy to the Architect:

SPECIFICATION SECTION:	PRINCIPAL SUBCONTRACTOR OR SUPPLIER - NAME and LOCATION:
SECTION 02 4100 - "DEMOLITION":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 03 3100 - "CONCRETE":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 03 3931 - "CURING, SEALING AND HARDENING CONCRETE FLOORS":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 03 4500 - "ARCHITECTURAL PRECAST CONCRETE":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 04 2000 - "UNIT MASONRY":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 04 7200 - "CAST STONE MASONRY":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

SECTION 05 1200 - “STRUCTURAL STEEL”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 05 3100 - “STEEL DECK”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 05 4000 – “COLD-FORMED METAL FRAMING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 05 4500 - “LIGHT GAUGE STEEL TRUSSES”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 05 5000 - “METAL FABRICATIONS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 05 5100 - “METAL STAIRS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 05 5213 - “PIPE AND TUBE RAILINGS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 06 1000 - “ROUGH CARPENTRY”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 06 2000 – "FINISH CARPENTRY":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

SECTION 06 4000 - "ARCHITECTURAL WOODWORK":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 1113 - "BITUMINOUS DAMPPROOFING":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 1300 - "SHEET WATERPROOFING":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 1400 - "FLUID-APPLIED AIR BARRIER":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 2100 - "THERMAL INSULATION":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 2216 - "ROOF BOARD INSULATION (VENTILATED NAIL BASE)":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 3113 - "ASPHALT SHINGLES":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 4244 - "FIBER CEMENT PANELS":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 6200 - "SHEET METAL FLASHING & TRIM":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

SECTION 07 7100 - “ROOF SPECIALTIES”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 7123 - “MANUFACTURED GUTTERS & DOWNSPOUTS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 8400 - “FIRESTOPPING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 07 9005 - “JOINT SEALERS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 08 1113 - “STEEL DOORS AND FRAMES”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 08 1416 - “FLUSH WOOD DOORS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 08 3100 - “ACCESS DOORS & PANELS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 08 4313 - “ALUMINUM-FRAMED STOREFRONTS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 08 5413 - “FIBERGLASS WINDOWS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

SECTION 08 7100 - “FINISH HARDWARE”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 08 8000 - “GLAZING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 09 2116 - “GYPSUM BOARD ASSEMBLIES”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 09 3000 - “TILING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 09 5100 - “SUSPENDED ACOUSTICAL CEILINGS”	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 09 6500 - “RESILIENT FLOORING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 09 6813 - “TILE CARPETING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 09 7200 - “WALL COVERINGS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 09 9100 - “PAINTING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

SECTION 10 1100 - “VISUAL DISPLAY UNITS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 10 1400 - “SIGNAGE”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 10 2113.18 - “PHENOLIC TOILET COMPARTMENTS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 10 2601 - “WALL AND CORNER GUARDS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 10 2800 - “TOILET AND BATH ACCESSORIES”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 10 4400 - “FIRE PROTECTION SPECIALTIES”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 10 5613 - “METAL STORAGE SHELVING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 10 5623 - “WIRE STORAGE SHELVING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 10 7316 - “CANOPIES”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

SECTION 10 7500 - “FLAGPOLES”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 11 3100 - “KITCHEN AND LAUNDRY EQUIPMENT”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 12 2113 - “HORIZONTAL LOUVER BLINDS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 12 3540 - “LAMINATE CASEWORK”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 12 4813 - “ENTRANCE MATS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 14 2010 - “PASSENGER ELEVATORS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
DIVISION 21 - FIRE SUPPRESSION:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
DIVISION 22 - PLUMBING SUBCONTRACTOR:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
DIVISION 23 - MECHANICAL SUBCONTRACTOR:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

DIVISION 26 - ELECTRICAL SUBCONTRACTOR:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
DIVISION 27 – COMMUNICATIONS:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
DIVISION 28 – ELECTRONIC SAFETY AND SECURITY:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 31 1000 - “SITE CLEARING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 31 2000 - “EARTH MOVING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 31 2500 - “EROSION AND SEDIMENTATION CONTROLS”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 31 3116 - “TERMITE CONTROL”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 32 1216 - “ASPHALT PAVING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 32 1313 - “CONCRETE PAVING”:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

SECTION 32 1613.13 - "CAST-IN-PLACE CONCRETE CURBS AND GUTTERS":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 32 1623 - "SIDEWALKS":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 32 1723 - "PAVEMENT MARKINGS":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 32 3113 - "CHAIN LINK FENCES AND GATES":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 32 3300 - "SITE FURNISHINGS":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 32 8400 - "PLANTING IRRIGATION":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 32 9200 - "TURF AND GRASSES:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
PLANTS:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 33 3000 – "SANITARY SEWERAGE UTILITIES":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

SECTION 33 4000 – "STORM DRAINAGE UTILITIES":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
SECTION 33 4613 – "FOUNDATION DRAINAGE":	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
OTHER:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
OTHER:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
OTHER:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
OTHER:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
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OTHER:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
OTHER:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
OTHER:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
OTHER:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)
OTHER:	_____; (FIRM NAME) _____. (LOCATION - CITY and STATE)

This list is not necessarily all inclusive. Submit all primary subcontractors whether their trade is listed here or not.

END OF ATTACHMENT "B" TO PROPOSAL FORM

ACCOUNTING OF SALES TAX
Attachment to
Proposal Form

To: _____ Date: _____
(Awarding Authority)

NAME OF PROJECT _____

_____

SALES TAX ACCOUNTING

Pursuant to Act 2013-205, Section 1(g) the Contractor accounts for the sales tax NOT included in the bid proposal form as follows:

ESTIMATED SALES TAX AMOUNT

BASE BID: …….$ _____

Alternate No. 1 (……..……..) (add)(deduct) $ _____
(Insert key word for Alternate)
Alternate No. 2 (……..……..) (add)(deduct) $ _____
Alternate No. 3 (……..……..) (add)(deduct) $ _____
Alternate No. 4 (……..……..) (add)(deduct) $ _____
Alternate No. 5 (……..…..) (add)(deduct) $ _____
Alternate No. 6 (……..…..) (add)(deduct) $ _____
Alternate No. 7 (……..……..) (add)(deduct) $ _____
Alternate No. 8 (……..……..) (add)(deduct) $ _____
Alternate No. 9 (……....) (add)(deduct) $ _____
Alternate No. 10 (……..) (add)(deduct) $ _____
Alternate No. 11 (……..) (add)(deduct) $ _____
Alternate No. 12 (……..) (add)(deduct) $ _____

Failure to provide an accounting of sales tax shall render the bid non-responsive. Other than determining responsiveness, sales tax accounting shall not affect the bid pricing nor be considered in the determination of the lowest responsible and responsive bidder.

Legal Name of Bidder _____

Mailing Address _____

* **By (Legal Signature)** _____

* Name (type or print) _____ *(Seal)*

* Title _____

Telephone Number _____

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IMMIGRATION STATUS VERIFICATION

1.1 GENERAL:

A. Bidders are hereby reminded that they are required to comply with requirements of Alabama Immigration Law, Act 2011-535 (also referred to as the "Beason-Hammon Alabama Taxpayer and Citizen Protection Act", or H.B. 56). This Law was amended by Act No. 2012-491 and signed into law by the Governor May 18, 2012. The following requirements are in effect:

1. Contractors are required to enroll in the E-Verify program of the United States Department of Homeland Security and to provide documentation of enrollment in the E-Verify program with their contracts and agreements. E-Verify MOU shall be submitted with Proposal Form.

2. Statement of Compliance with Act No. 2012-491 shall be attached to Construction Contract, and shall include the following statement:

> ***By signing this contract, the contracting parties affirm, for the duration of the agreement, that they will not violate federal immigration law or knowingly employ, hire for employment, or continue to employ an unauthorized alien within the State of Alabama. Furthermore, a contracting party found to be in violation of this provision shall be deemed in breach of the agreement and shall be responsible for all damages resulting therefrom.***

B. Additional information and Guidance is available at the following websites:

1. E-Verify portal maintained by State of Alabama: http://immigration.alabama.gov

2. Alabama Department of Finance, Comptroller's Website - Compliance Guidelines: http://comptroller.alabama.gov/pdfs/Memos/2012-01-06%20Alabama%20Immigration%20Law.pdf

3. Alabama Secretary of State's Website: Including in part, rules and acceptable form for affidavits for business entities, employers, contractors, and subcontractors. http://www.sos.state.al.us/

4. Alabama Building Commission: http://www.bc.state.al.us/Memo%20on%20Act%202011-535-Alabama%20Immigration%20Law-1-11-2012.pdf

5. US Department of Homeland Security, E-Verify: www.dhs.gov/E-Verify

JULIE P. MAGEE
Commissioner

State of Alabama
Department of Revenue
(www.revenue.alabama.gov)
50 North Ripley Street
Montgomery, Alabama 36132

MICHAEL E. MASON
Assistant Commissioner
JOE W. GARRETT, JR.
Deputy Commissioner
CURTIS E. STEWART
Deputy Commissioner

Alabama Department of Revenue
NOTICE

Tax Guidance for Contractors, Subcontractors and Alabama Governmental Entities Regarding Construction-related Contracts

Legislative Act 2013-205 requires the Department of Revenue to issue Form STC-1, *Sales and Use Tax Certificate of Exemption for Government Entity Projects,* to all contractors and subcontractors working on qualifying governmental entity projects once the Form ST: EXC-01 is approved.

Each exempt entity, contractor and subcontractor must make application for qualification of the exemption using Form ST: EXC-01 for each tax-exempt project. The application is available on the department's website at http://revenue.alabama.gov/salestax/ST-EXC-01.pdf. Applications should be submitted directly to the Sales and Use Tax Division Central Office, P.O Box 327710, Montgomery, AL 36132-7710.

The sales and use tax exemption provided for in Act 2013-205 applies to the purchase of building materials, construction materials and supplies, and other tangible personal property that become part of the structure pursuant to a qualifying contract entered into on or after January 1, 2014. Qualifying projects and contracts are those generally entered into with the following governmental entities, unless otherwise noted: the State of Alabama, a county or incorporated municipality of Alabama, an Alabama public school, or an Alabama industrial or economic development board or authority already exempt from sales and use taxes. **Please note that contracts entered into with the federal government and contracts pertaining to highway, road, or bridge construction or repair do not qualify for the exemption provided for in Act 2013-205.** [Reference: Sales and Use Tax Division Administrative Rule 810-6-3-.77 *Exemption for Certain Purchases by Contractors and Subcontractors in Conjunction with Construction Contracts with Certain Governmental Entities.*]

The Alabama Department of Revenue will assign each contractor and sub-contractor a consumers use tax account, if one is currently not in place, at the time the Form STC-1, Sales *and Use Tax Certificate of Exemption for Government Entity Projects*, is issued.

Contractors and sub-contractors for qualifying projects will be required to file monthly consumers use tax returns and report all exempt purchases for ongoing projects, as well as all taxable purchases on one return. These returns are required to be filed through the department's online tax return filing and payment portal, My Alabama Taxes (https://myalabamataxes.alabama.gov).

As another option for these types of contracts, as well as with other contracts entered into with other types of exempt entities, the Form ST:PAA1, *Purchasing Agent Appointment*, may be used. However, please be advised that the use of the Form ST:PAA1 option will require the exempt entity to be invoiced directly and pay for directly from their funds any construction and building material and supply purchases.

For additional information concerning this guidance, taxpayers should contact Sales and Use Tax Division representative Thomas Sims at 334-242-1574 or by email at Thomas.Sims@revenue.alabama.gov.

ST: EXC-01
1/14

ALABAMA DEPARTMENT OF REVENUE
SALES AND USE TAX DIVISION
P.O Box 327710 • Montgomery, AL 36132-7710

Application For Sales and Use Tax Certificate of Exemption

FOR GOVERNMENT ENTITY PROJECT

This Certificate of Exemption will be limited to purchases which qualify for an exemption of sales and use taxes pursuant to Rule No. 810-6-3-.77

PROJECT INFORMATION:

PROJECT NAME				PROJECT OWNER'S FEIN (EXEMPT ENTITY)
STREET ADDRESS OF PROJECT (CITY AND COUNTY INCLUDED)	**CITY**	**ZIP**	**COUNTY**	

APPLICANT'S INFORMATION:

RELATION: *(CHOOSE ONE)*			NAICS CODE
☐ Exempt Entity ☐ General Contractor ☐ Sub-Contractor			
APPLICANT'S LEGAL NAME			FEIN
DBA			CONSUMER'S USE TAX ACCOUNT NUMBER

MAILING ADDRESS

CONTACT PERSON	BUSINESS TELEPHONE NUMBER
	( )

ESTIMATED START DATE	ESTIMATED COMPLETION DATE

REASON EXEMPTION IS CLAIMED

JOB DESCRIPTION

WILL ANY POLLUTION CONTROL EXEMPTION BE APPLICABLE?	ESTIMATED POLLUTION CONTROL COST
☐ Yes ☐ No	$

TOTAL BID AMOUNT	LABOR COST	MATERIAL COST
$	$	$

PROJECT NAME	PROJECT OWNER'S FEIN (EXEMPT ENTITY)

FORM OF OWNERSHIP:

☐ Individual ☐ Partnership ☐ Corporation ☐ Multi member LLC ☐ Single member LLC

If applicant is a corporation, a copy of the certified certificate of incorporation, amended certificate of incorporation, certificate of authority, or articles of incorporation should be attached. If the applicant is a limited liability company or a limited liability partnership, a copy of the certified articles of organization should be attached.

OWNERSHIP INFORMATION:

Corporations – give name, title, home address, and Social Security Number of each officer.

Partnerships – give name, home address, Social Security Number or FEIN of each partner.

Sole Proprietorships – give name, home address, Social Security Number of owner.

LLC – give name, home address, and Social Security Number or FEIN of each member.

LLP – give name, home address, and Social Security Number or FEIN of each partner.

NAME *(PLEASE PRINT)* SIGNATURE

TITLE DATE

Exempt entity must provide a copy of the contract accepted by the General Contractor. The General Contractor must provide a copy of the contract and a list of sub-contractors to the Department of Revenue, Sales and Use Tax Division. Any updates, additions and/or deletions, must also be submitted to the Department within 30 days of occurrence.

REVENUE DEPARTMENT USE ONLY

Examiner's Remarks _____

Examiner _____ Date _____

Supervisor's Recommendation _____

Supervisor _____ Date _____

BID BOND FORM

1.1 Bid Bond shall be executed equivalent to AIA Document A310, Bid Bond. A draft copy is attached for reference. Copies of A310 are available for viewing in the office of the Architect, and may be purchased from an AIA documents vendor by the Contractor.

END OF BID BOND FORM

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AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

BOND AMOUNT: $

PROJECT:
(Name, location or address, and Project number, if any)

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a

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This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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common law bond.

Signed and sealed this day of ,

(Contractor as Principal)	*(Seal)*
(Witness)	*(Title)*
(Surety)	*(Seal)*
(Witness)	*(Title)*

DRAFT

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CONSTRUCTION CONTRACT FORM

1.1 The Construction Agreement shall be executed on A.I.A. Document A101 - 2017 Edition, a copy of which is attached for reference. Copies are available for viewing in the office of the Architect, and may be purchased from an A.I.A. documents vendor by the Contractor.

END OF CONSTRUCTION CONTRACT FORM

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AIA® Document A101® – 2017

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the day of in the year
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

and the Contractor:
(Name, legal status, address and other information)

for the following Project:
(Name, location and detailed description)

The Architect:
(Name, legal status, address and other information)

The Owner and Contractor agree as follows.

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This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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TABLE OF ARTICLES

1 THE CONTRACT DOCUMENTS

2 THE WORK OF THIS CONTRACT

3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

4 CONTRACT SUM

5 PAYMENTS

6 DISPUTE RESOLUTION

7 TERMINATION OR SUSPENSION

8 MISCELLANEOUS PROVISIONS

9 ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[ ] The date of this Agreement.

[ ] A date set forth in a notice to proceed issued by the Owner.

[ ] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve

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Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

[ ] Not later than ( ) calendar days from the date of commencement of the Work.

[ ] By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

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ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than ( ) days after the Architect receives the Application for Payment. *(Federal, state or local laws may require payment within a certain period of time.)*

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

- **.1** That portion of the Contract Sum properly allocable to completed Work;
- **.2** That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- **.3** That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

- **.1** The aggregate of any amounts previously paid by the Owner;
- **.2** The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
- **.3** Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- **.4** For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
- **.5** Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

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(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

%

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.

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(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[ ] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[ ] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

§ 8.3 The Contractor's representative:

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(Name, address, email address, and other information)

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with a building information modeling exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with a building information modeling exhibit, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction

.4 Building information modeling exhibit, dated as indicated below:
(Insert the date of the building information modeling exhibit incorporated into this Agreement.)

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

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Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[ ] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
(Printed name and title)	*(Printed name and title)*

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PERFORMANCE BOND AND PAYMENT BOND FORM

1.1 Performance and Payment Bond shall be provided for 100% of the Contract amount, and shall be executed on AIA Document A312, latest edition. A draft of AIA Document A312 – 2010 is attached. Copies of document are available for viewing in the office of the Architect, and can be purchased from an AIA documents vendor by the Contractor and/or their surety.

END OF PERFORMANCE BOND AND PAYMENT BOND FORM

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AIA® Document A312® – 2010

Performance Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:
Amount: $
Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)
Amount: $
Modifications to this Bond:

(Any additional signatures appear on the last page of this Performance Bond.)

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*
Signature: _____
Name and Title:

SURETY
Company: *(Corporate Seal)*
Signature: _____
Name and Title:

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

ADDITIONS AND DELETIONS:
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This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors ef assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

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.2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

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AIA® Document A312® – 2010

Payment Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:
Amount: $
Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)
Amount: $
Modifications to this Bond:

(Any additional signatures appear on the last page of this Payment Bond.)

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*

Signature: _____
Name and Title:

SURETY
Company: *(Corporate Seal)*

Signature: _____
Name and Title:

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

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This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

- **.1** have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
- **.2** have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

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§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- **.1** the name of the Claimant;
- **.2** the name of the person for whom the labor was done, or materials or equipment furnished;
- **.3** a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- **.4** a brief description of the labor, materials or equipment furnished;
- **.5** the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- **.6** the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- **.7** the total amount of previous payments received by the Claimant; and
- **.8** the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under

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the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

(Any additional signatures appear on the last page of this Payment Bond)

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GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

1.1 The "General Conditions of the Contract for Construction," A.I.A. Document A201, 2017 Edition, (also referred to as "General Conditions", "Conditions of the Contract", etc.), Articles 1 through 15, inclusive, is a part of this contract, and is incorporated herein as fully as if here set forth.

1.2 Copies of A.I.A. Document A201 are available for viewing in the office of the Architect, and can be purchased from an A.I.A. documents vendor by the Contractor.

1.3 See "Supplementary Conditions" and "Special Conditions" for supplements which modify, change, delete, and/or add to the General Conditions.

1.4 A draft copy of A201 – 2017 is attached for reference.

END OF GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

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AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

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For guidance in modifying this document to include supplementary conditions, see AIA Document A503™–2017, Guide for Supplementary Conditions.

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14 TERMINATION OR SUSPENSION OF THE CONTRACT

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

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§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon written protocols governing the transmission and use of, and reliance on, Instruments of Service or any other information or documentation in digital form.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to written protocols governing the use of, and reliance on, the information contained in the model shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model,

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and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

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§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of

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facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be

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of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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.1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

.2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

.3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

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§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such

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services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

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§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

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§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract,

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shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- **.1** assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- **.2** assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The

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Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

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§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- **.1** The change in the Work;
- **.2** The amount of the adjustment, if any, in the Contract Sum; and
- **.3** The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- **.1** Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- **.2** Unit prices stated in the Contract Documents or subsequently agreed upon;
- **.3** Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- **.4** As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- **.1** Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- **.2** Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- **.3** Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- **.4** Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- **.5** Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the

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Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

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§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later

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than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- **.5** damage to the Owner or a Separate Contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- **.7** repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint

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checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is

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sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

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§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

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§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

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§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage,

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the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the

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damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor

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to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

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§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- **.3** Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- **.4** The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.1** repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- **.2** fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- **.3** repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- **.4** otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

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.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

.1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not

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more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- **.1** damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- **.2** damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition

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precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

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§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

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User Notes: (640e2aedf442e4498d0967fa)

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SUPPLEMENTARY CONDITIONS

1.1 GENERAL CONDITIONS:

A. The "General Conditions of the Contract for Construction", AIA Document A201, 2017 Edition, Articles 1 through 15, inclusive, (General Conditions or Conditions of the Contract hereinafter) is a part of this contract, and is incorporated herein as fully as if here set forth.

2.2 SUPPLEMENTS:

A. The following supplements, modify, change, delete or add to the General Conditions. Where any part of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered provisions of that part shall remain in effect.

1. ARTICLE 1 - GENERAL PROVISIONS:

a. Add the following new subparagraph:

"1.5.3 Any written permission given for use of the Drawings, Specifications, and/or other Documents prepared by the Architect and/or the Architect's consultants which is provided under the terms of this Article, shall require and be subject to payment to the Architect for such use, as determined to be equitable by the Architect or as mutually agreed in writing between the Architect and the party or parties requesting and receiving permission for any such use."

b. Add the following new Subparagraphs:

1.6.1 The Architect may, with the concurrence of the Owner, furnish to the Contractor versions of Instruments of Service in electronic form. The Contract Documents executed or identified in accordance with Subparagraph 1.1.1 shall prevail in case of an inconsistency with subsequent versions made through manipulatable and/or non-manipulatable electronic operations involving computers.

1.6.2 The Contractor shall not transfer or reuse Instruments of Service in electronic or machine readable form without the prior written consent of the Architect, and payment to the Architect in amount(s) agreeable to the Architect for such use.

1.6.3 Representatives of the Owner, Contractor, and/or Architect shall meet periodically, if required by the Owner or Architect, at mutually agreed-upon intervals for the purpose of establishing procedures to facilitate cooperation, communication and timely responses among the participants. By participating in this arrangement, the parties do not intend to nor will they create additional contractual obligations or modify the legal relationships which may otherwise exist."

2. ARTICLE 2 - OWNER:

a. Refer to Paragraph 2.2.2, and add the following new Subparagraphs:

2.2.2.1 The Contractor shall secure and pay for all necessary permits, fees, etc., as necessary for the execution and completion of the Work of the project, unless specifically indicated otherwise within the Bid and Contract Documents; Which shall include in part, building permit, inspection fees, utility connection fees, utility impact fees, licenses, and other charges which may be applicable and/or due at the time when bids were received or negotiations concluded.

2.2.2.2 Unless specifically indicated otherwise on the Drawings or in the Project Manual, the Owner will furnish all necessary Environmental and Storm Water permits customarily required for this type of project; The Contractor shall comply with the requirements and directions of the Owner and/or imposed on the Owner for compliance with these requirements.

b. Add the following new paragraph:

"2.2.5 The Contractor will make these documents available in electronic format (PDF) for subcontractors to download."

3. ARTICLE 3 - CONTRACTOR:

a. Refer to Paragraph 3.2, and add the following new Subparagraph:

"3.2.5 The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for the Architect to evaluate and respond to the Contractor's requests for information, where such information was available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination Drawings, or prior Project correspondence and/or documentation."

b. Refer to Paragraph 3.3, and add the following new Subparagraph:

"3.3.4 The Contractor shall lay out their own work. They shall be responsible for all work executed by them under the Contract which shall be constructed to the lines and grades as shown on the Drawings. They shall verify all figures and elevations before proceeding with the work, and will be held responsible for any error resulting from failures to do so."

c. Delete Paragraph 3.4.2, and substitute the following:

"3.4.2 After the Contract has been executed, the Owner and Architect will consider a formal request for the substitution of products in place of those specified, only under the conditions set forth in the General Requirements (Division 1 of Specifications). By making requests for substitutions, the Contractor:

3.4.2.1 represents that the Contractor has personally investigated the proposed substitute product and determined that it is equivalent to or superior in all respects to that specified;

3.4.2.2 represents that the Contractor will provide at least the same warranty for the substitution that the Contractor would for that specified;

3.4.2.3 certifies that the cost data presented is complete and includes all related costs under this Contract, except the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and

3.4.2.4 will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects."

d. Add the following new Subparagraph:

"3.4.4 The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect to evaluate the Contractor's proposed substitutions, regardless of whether or not the proposed substitution is subsequently accepted by the Owner and/or Architect, and to make agreed-upon changes in the Drawings and Specifications made necessary by the Owner's acceptance of such substitutions."

e. Revise the following Subparagraphs:

Before the semicolon at the end of Subparagraph 3.8.2.2, add the following:

", except that if installation is included as part of an allowance in Divisions 1-16 of the Specifications, the installation and labor cost for greater or lesser quantities of Work shall be determined in accordance with Subparagraph 7.3.7, unless specifically indicated otherwise;"

Refer to Subparagraph 3.8.2.2, and add the following after the word "profit":
", temporary storage,"

Refer to Subparagraph 3.8.2.3, and add the following phrase at the end:

", which could not reasonably be anticipated by the Contractor at the time of bidding, and/or which are not due to any cause or delay by the Contractor, and/or which are due to causes over which the Contractor had no control."

f. Refer to Subparagraph 3.9.2, and add the following new Subparagraphs:

"3.9.2.1 Contractor's Superintendent shall be properly qualified and have a minimum of five (5) years experience as superintendent for this Contractor. Contractor shall furnish within five days of their receipt of the Contract, records of proposed Superintendent's education and experience, construction project experience and in what capacities, names of architects for these projects, and

information sufficient to determine suitability for the proposed position for this project.

3.9.2.2 Refer to Division 1 Section "Special Conditions", and individual specifications sections throughout the Project Manual, for additional information and minimum experience requirements."

g. Refer to Subparagraph 3.10.3, and add the following at the end:

"If the project is behind the Construction Schedule, the Contractor shall act on each portion which is not in general accordance with the Construction Schedule, to whatever extent is required to move progress of the Work back into general accordance with the Construction Schedule, at no additional cost to the Owner."

h. Refer to Subparagraph 3.12.7, and change the word "approved" to read "reviewed".

i. Refer to Subparagraphs 3.12.8 and 3.12.9, and revise the following:

Change the word "approved" to read "reviewed", wherever it occurs.

Change the word "approval" to read "review", wherever it occurs.

j. Add the following new Subparagraph:

"3.12.11 The Architect's review of Contractor's submittals will be limited to examination of an initial submittal and ONE (1) resubmittal. The Architect's review of additional submittals will be made only with the consent of the Owner, after notification by the Architect. The Owner shall be entitled to deduct from the Contract Sum, amounts due to the Architect for evaluation of such additional resubmittals."

k. Refer to Subparagraph 3.15.1, and add the following new Subparagraph:
"3.15.1.1 Remove broken or scratched glass and replace with new glass, remove paint droppings, spots, stains, and dirt from finished surfaces and exposed concrete, masonry, stucco, and similar surfaces, and clean plumbing fixtures, hardware, floors, and equipment. Contractor shall keep interior of the building free of stored or unattended combustible material."

4. ARTICLE 4 - ADMINISTRATION OF THE CONTRACT:

a. Refer to Subparagraph 4.2.7, and revise as follows:

In first sentence, after the word "approve", add "and/or make comments," .

In the last two sentences, change the word "approval", to read "review and/or approval".

b. Refer to Subparagraph 4.2.9, and change the word "inspections", to read "construction observations and final inspection(s)".

5. ARTICLE 5 - SUBCONTRACTORS:

a. Refer to Subparagraph 5.2.1, and add the following new Subparagraph:

"5.2.1.1 Submittal of list as required of the Contractor, shall include all major Subcontractors and Suppliers, and shall be submitted not later than, either along with the Contractor's completed Proposal Form, or shall be submitted to the Owner, with copy to Architect, within 24-hours of the time and date that bids are scheduled to be opened. Refer to Division 1 Section "Special Conditions" for additional information and minimum requirements."

6. ARTICLE 7 - CHANGES IN THE WORK:

a. Refer to paragraph 7.2 Change Orders, and add the following new Subparagraph 7.2.2.

"7.2.2 Change Orders for this project shall have a total of 25% maximum mark-up if sub-contractor and general contractor are involved. Sub-contractor shall have 15% mark-up (10% to cover overhead such as insurance, bond, labor, labor burden, etc. and the remaining 5% for profit). Contractor shall have 10% mark-up (5% to cover all overhead as mentioned above under sub-contractor, and 5% for profit). If the general contractor self-performs the work then they shall be allowed 15% mark-up.

Should changes which will decrease the cost of the work be ordered by the Architect, then the Contract Price shall be reduced by an amount equal to the agreed estimated saving resulting from these changes, and further reduced by the Contractor's and Subcontractor's, if applicable, overhead and profit.

7. ARTICLE 8 - TIME:

a. Refer to Subparagraph 8.1.2, and add the following new Subparagraph:

"8.1.2.1 The date of commencement shall be established as the earlier of either the date the Contractor receives the fully executed Contract, or the date indicated on the Owner's written "Notice To Proceed", unless mutually agreed otherwise and in writing between the Owner and the Contractor."

b. Refer to Subparagraph 8.2.2, and revise as follows:

At end of first sentence, omit the words "and Owner".

8. ARTICLE 9 - PAYMENTS AND COMPLETION:

a. Refer to Subparagraph 9.2, and change the word "Architect", to read "Architect and/or Owner", wherever it occurs.

b. Refer to Subparagraph 9.3.1, and add the following sentence and new Subparagraphs:

"The form of Application of Payment, duly notarized, shall be a current authorized edition of AIA Document G702, or approved equivalent document, supported by a current authorized edition of AIA Document G703 or approved equivalent continuation sheet.

9.3.1.3 Until the Work is **100-percent complete**, the Owner shall pay **95-percent of the first 50-percent** of the amount due the Contractor on account of progress payments, **and no additional retainage thereafter,** except as otherwise provided. Unless for reasons otherwise provided in the Contract Documents, thereafter, there will be no further retainage withheld.

9.3.1.4 Upon completing all requirements to achieve Substantial Completion, as defined within the Contract Documents, the payment shall be sufficient to increase the total payments to **98-percent of the contract sum**, less such amounts as the Architect and/or Owner shall determine for all incomplete work and unsettled claims, except as otherwise provided."

c. Refer to Subparagraph 9.7, and revise as follows:

Change the word "seven", to read "ten", wherever it occurs.

Omit the last nine words, beginning with ", plus…" through the word "Documents".
Add the following Sentence: "In the event it is deemed necessary by the Architect and/or Owner to return a request and/or requests for progress payment to the Contractor, the time limits indicated herein for payment shall begin from the date of receipt of a request for progress payment which is subsequently resubmitted, and found acceptable by the Architect and/or Owner."

d. Refer to Subparagraph 9.8.3, and add the following new Subparagraph:

"9.8.3.1 Except with the consent of the Owner, the Architect will perform no more than one (1) inspection and one (1) reinspection to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for any additional inspections and/or re-inspections due to incomplete work and/or unsettled claims."

e. Refer to Subparagraph 9.8.5, delete the second sentence, and substitute the following:

"Upon such acceptance and consent of surety, if any, the Owner shall make payment sufficient to increase the total payments to 98-percent (98%) of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work and unsettled claims."

f. Refer to Subparagraph 9.10.1, and add the following new Subparagraph:

"9.10.1.1 Except with the consent of the Owner, the Architect will perform no more than one (1) inspection and one (1) reinspection to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for any additional inspections and/or re-inspections due to incomplete work, unsettled claims and/or other cause or causes attributable to the responsibilities of the Contractor."

9. ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY:

a. Refer to Subparagraph 10.1, and add the following:

"In performing this work, the Contractor shall in part, take all necessary precautions for ample protection of personnel, property, and equipment from falling debris, dust, or undue exposure to weather. The safety provisions of applicable laws, building and construction codes shall be observed and applicable provisions of the latest edition of the AGC "Manual of Accident Prevention" shall be adhered to and followed. All passageways, guard fences, lights and other facilities required for protection of the public and workmen shall be provided and maintained."

10. ARTICLE 11 - INSURANCE AND BONDS:

a. Delete Paragraphs 11.2, 11.3, and 11.4, and replace with the following:

"11.2 CONTRACTOR'S AND SUBCONTRACTOR'S MINIMUM LIABILITY INSURANCE:

11.2.1 The insurance required by Subparagraph 11.1 shall be written for not less than the following minimum limits of liability, or greater if required by law. **Additionally named primary insureds shall be *"the Owner, Architect, and their Consultants"*, except not on Worker's Compensation; all insurance certificates shall provide for "Waiver of Subrogation" against *"the Owner, Architect, and their Consultants"*, by the Contractor, each Subcontractor, and their insurers.** Refer also to Division 1 Section "Special Conditions", for additional information and requirements.

11.2.2 **MINIMUM COVERAGE(S) REQUIRED:**

11.2.2.1 Workers' Compensation:

a.	State	Statutory
b.	Applicable Federal	Statutory
c.	Employer's Liability	$1,000,000
d.	Benefits Required by Union Labor Requirements	As applicable.
e.	Voluntary Compensation	$1,000,000

f. Broad Form all states Endorsement.

11.2.2.2 Comprehensive General Liability:

a. Including Premises-Operations; Independent Contractors' Protective; Products and Completed Operations; Broad Form Property Damage; Contractual Liability; Personal Injury; all as combined single limits:

1) General Aggregate: $2,000,000, with general aggregate of $2,000,000 applicable to this project only; including in part, Bodily Injury/Property Damage $2,000,000 each occurrence.

2) Products/Completed Operations: $2,000,000 annual aggregate.

Products and Completed Operations Insurance shall be maintained for three (3) years after the work has been completed; property damage liability insurance shall provide X, C, and U coverage; Fellow Employee suits shall be included.

3) Personal and Advertising Injury: $1,000,000 per occurrence.

4) Each Occurrence: $1,000,000.

11.2.2.3 Comprehensive Commercial Business Automobile Liability (owned, non-owned, hired):

a. Combined single limits for bodily injury and property damage:

1) Bodily Injury/Property Damage $1,000,000 each occurrence.

11.2.2.4 Aircraft Liability (owned and non-owned) when applicable:

a. Furnish proof of coverage with the following limits (combined single limits for bodily injury and property damage):

1) Admitted liability $1,000,000 per seat.

2) Bodily Injury/Property damage $1,000,000 each occurrence.

11.2.2.5 Commercial Umbrella Excess Liability over Primary Insurance:

a. $4,000,000 each occurrence.
b. Products/Completed Operations: $4,000,000 aggregate.

c. General Aggregate: $4,000,000.

11.2.2.6 Indemnity:

a. The Contractor shall assume all liability for and shall indemnify and save harmless the Owners, Architect, and their consultants and employees from: All damages and liability for injury to any person or persons, and injury to or destruction of property, including the loss of use thereof, by reason of an accident or occurrence arising from operations under the Contract, whether such operations be by himself, or by any subcontractor or by anyone directly or indirectly employed by either of them, occurring on or about the premises or the ways and means immediately adjacent, during the term of the contract, or any extension thereof, and shall also assume the liability for injury and/or damages to adjacent or neighboring property by reason of work done under this Contract; The obligations of the work done under this Contract. The obligations of the contractor under this paragraph shall not extend to the liability of the Architect, his agents or employees arising out of:

1) The preparation or approval of maps, drawings, opinions, reports, surveys, Change Orders, design or specifications, or;

2) The giving or the failure to give directions or instructions by the Architect, his agents or employees, upon request, provided such giving of or failure to give is the primary cause of the injury or damage.

The insurance shall extend to and include all of the contractor's operations, regardless of whether they may be in connection with work that is temporary, permanent, included in any of the bid items or classified as extra work.

A statement of the above indemnity coverage and condition shall be included on the Insurance Certificate or Policy.

11.2.2.7 Certificates of Insurance acceptable to the Owner shall be filed with the Owner prior to signing of the Contract for the Work of this project, and along with the required 100% Performance and 100% Payment Bonds (100% of Contract amount), shall be attached to the Contract(s). These certificates shall contain a provision that policy coverage will not be changed or canceled until at least thirty (30) days prior written notice has been given the Owner and Architect, which may be reduced to at least ten (10) days for non-payment of premium only.

a. Provide copies of policies renewed, altered and/or replaced during the Work of this project, to the Owner within 10-days of their effective date(s), with copy sent to the Architect.

11.3 PROPERTY INSURANCE:

11.3.1 The Contractor shall provide an All Risk ("open perils") Builder's Risk Policy with a replacement cost valuation, to cover the interests of all contractor's and sub-contractors of any tier. The contractor and subcontractors of any tier shall be responsible for all risks of physical loss to the work not otherwise covered, including in part, portions of the work stored off the site and in transit between off site storage and site.

11.3.2 The total amount of the insurance shall be the amount of the contract.

11.3.3 The policy or policies shall be endorsed to waive all rights of subrogation among, between, and to each insured under the policy.

11.3.4 The "Owner, Architect, and their Consultants" shall be additionally named primary insureds under the policy or policies. Refer also to Division 1 Section "Special Conditions", for additional information and requirements.

11.3.5 Any deductibles will be apportioned to the named insureds (but excluding those named in 11.3.4) as their interests may appear, based upon claim payments.

11.3.6 Any claims coming under the terms and conditions of the policies shall be immediately reported by written notice to the Architect, with a copy to the Owner:

Goodwyn, Mills & Cawood, Inc.
2701 First Avenue South, Suite 100
Birmingham, Alabama 35233
Phone: (205) 879-4462

11.4 PERFORMANCE AND PAYMENT BOND:

11.4.1 The Contractor and subcontractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder. Bonds may be obtained through the Contractor's usual source, and the cost thereof shall be included in the Bid and Contract Sum. The amount of each bond shall be equal to 100-percent (100%) of the Contract Sum.

11.4.1.1 The Contractor shall deliver the required bonds to the construction manager attached to each copy of the Contract which the Contractor is presented to execute for the Work of the Project.

11.4.1.2 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the Power of Attorney."

11. ARTICLE 12 - UNCOVERING AND CORRECTION OF WORK:

a. Refer to Subparagraph 12.2.2, and add the following new Subparagraphs:

"12.2.2.1.1 For the purposes of this paragraph, "reasonable time" shall be defined as within ten (10) consecutive calendar days from and after receipt of notice from the Owner and/or Architect."

"12.2.2.4 Upon request by the Owner, and prior to the expiration of the expiration of one year from the date of Substantial Completion, the Architect will conduct and the Contractor shall attend a meeting with the Owner to review the facility operations and performance."

12. ARTICLE 15 - CLAIMS AND DISPUTES

a. Refer to Subparagraph 15.1.5, and add the following new Subparagraphs:

"15.1.5.1 Claims for increase in the Contract Time shall set forth in detail circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work, and the number of normal working days' increase in the Contract Time claimed as a consequence of each such cause of delay. The Contractor shall provide such supporting documentation as the Owner may require, including where appropriate, a revised construction schedule indicating all the activities affected by the circumstances forming the basis of the Claim.

15.1.5.2 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor.

15.1.5.3 Refer to Division 1 Section "Special Conditions" and other applicable portions of the Bid and Contract Documents for additional information, requirements, reporting requirements, limitations and exclusions relating to claims for additional time."

END OF SUPPLEMENTARY CONDITIONS

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Goodwyn Mills Cawood

2400 5th Avenue South
Suite 200
Birmingham, AL 35233

T (205) 879-4462

www.gmcnetwork.com

Special Provisions of the Contract Documents:
Add the following:

Under no circumstance will GMC provide hard copy sets of drawings, project manuals, or other contract documents. Upon request from bidders, GMC will provide electronic (PDF) sets of drawings and project manuals prior to award of contract. Upon award of contract, the General Contractor may request digital sheet files using the Electronic File and Transfer Agreement Form and its appropriate procedures and fees.

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Goodwyn Mills Cawood

2400 5th Avenue South
Suite 200
Birmingham, AL 35233

T (205) 879-4462

www.gmcnetwork.com

Electronic File Conversion and Transfer Agreement

Goodwyn Mills Cawood, LLC. (GMC) in cooperation with its Consultants may, at its sole discretion, provide electronic document and file conversion services to the prime entity holding, or intending to enter into, an Agreement with an Owner for construction of a Project. GMC will typically accept only one request per project from one entity, typically the General Contractor.

Consultants referred to herein are all consultants to GMC for or in connection with the Project, including but not limited to those listed below.

It is acknowledged that neither GMC nor its Consultants are under any obligation to furnish electronic files to any party. The General Contractor and/or Sub-contractors should not, under any circumstances, assume they will receive any or all requested electronic files. Whether files are provided or not, the General Contractor remains completely responsible for performing all work required of the Contract Documents in full, including the preparation of accurate and detailed required shop-drawings.

When furnished, files will be transmitted electronically via FTP Site, or similar file transfer mechanism. It is the intent of GMC to furnish files in a timely manner, typically within two (2) weeks of receipt of payment of fees. However, the complexity and scale of the conversion is directly related to the requested file format and quantity of files requested. Where GMC believes a request will require additional time, we will notify the User and make reasonable effort to deliver files in phases if beneficial.

Please contact Alyssa Martin at (205) 879-4462 with any questions.

GOODWYN MILLS CAWOOD, LLC.

PROJECT

Project Name:

Project No.:

Document Issue Date:

Prime/Architect/Engineer: GOODWYN MILLS CAWOOD, LLC.

Consultants:

Goodwyn Mills Cawood, LLC. (hereafter "GMC"), for itself and its identified Consultants, hereby grants non-exclusive use of the requested electronic files to the party (User) listed below. User accepts that GMC and its Consultants reserve the right to convey or not convey electronic files at their sole discretion. User further agrees, as a precedent to transmittal of digital files to any other party, to require written agreement of equivalent confidentiality and indemnification provisions from any party that receives the digital files. The digital information furnished under this agreement is proprietary, is the property of GMC and/or its Consultants, and is protected by applicable copyright laws.

The information provided by GMC and/or its Consultants is solely for the convenience of the recipient. Neither GMC nor its Consultants make any warranty or guarantee, express or implied, as to the suitability of the files for any specific purpose. It is understood the files are (1) digital, (2) typically have been converted electronically into a format suitable to the User, (3) are inherently capable of being manipulated and altered through intentional and unintentional means, (4) are partial and therefore inherently incomplete representations of the Contract Documents, and (5) may include inaccuracies clarified elsewhere in the Contract documents. Consequently, ONLY the COMPLETE Printed Contract Documents, as amended, shall serve as the basis for the scope, quantity, and quality of the work required for the Project. Under no circumstances whatsoever shall GMC and/or its Consultants be or become liable to anyone for the accuracy or completeness of information included in requested electronic files. The burden of, and responsibility for, determining the fitness of data included in electronic files falls solely and completely on the User.

LIMITED USE: The use of any digital file(s) is solely limited to the listed Project below. In no event shall files be utilized for any other Project, or any use beyond the use specifically listed herein. Further, under no circumstances may the General Contractor or and Sub-Contractor submit files furnished under this Agreement as required shop drawing submittals. By execution of this Agreement, the User acknowledges these limitations, and shall comply fully therewith.

CONFIDENTIALITY: User agrees to hold Project information strictly confidential, and User agrees it shall limit the use of transmitted electronic files solely to those applications necessary to perform work required for the Project.

INDEMNIFICATION: User hereby agrees to indemnify, defend, and hold harmless GMC, its directors, officers, and employees, and its Consultants, Consultant's directors, Consultants officers and employees, and the insurers, agents, and affiliates of both GMC and its Consultants, from any and all liability including claims for consequential damages or attorney's fees that may arise out of or relate in any matter to the authorized or unauthorized use, reuse, or alteration of this information by User, its employees or agents, vendors, contractors, sub-contractors, or any other party.

REVISIONS: The Contract Documents are subject to change, and revisions are not always incorporated throughout the documents. It is the User's sole responsibility to review the complete current Contract Documents, and identify inconsistencies between the electronic files and the current Contract Documents.

DIGITAL PROTOCOL: The USER is solely responsible for examination of digital files for virus contamination. Neither GMC nor its Consultants, or the directors, officers, employees, insurers, agents, or affiliates of either are responsible for damages incurred due to virus contamination, or for software version and/or file compatibility, or any similar hardware or software compliance issues.

FEE STRUCTURE: Prior to conversion of files, GMC must receive this complete Electronic File Conversion and Transfer Agreement, completed in full, and executed by a representative of the User with authorization to enter into contracts on behalf of the User.

			PER SHEET FEE
Civil	C		$125
Architecture	A		$150
Structural	S		$125
Mechanical	M, P, FP		$125
Electrical	E		$125
Acoustical & AV	AV		$125
Other	G, FS, etc.		$100

USER ACCEPTANCE OF AGREEMENT

Company Name: _____

By: _____ Date: _____

Its: _____

REQUESTED FILE FORMAT

User (Select ONE)	File Format
☐	Bound Auto CAD Release 2007
☐	Bound Auto CAD Release 2010
☐	Bound Auto CAD Release 2013
☐	Bound Auto CAD Release 2018

SCHEDULE OF REQUESTED FILES (To be filled by User)

SHEET		INTENDED USE		FEE	
No.	Name				

(PRINT ADDITIONAL FORMS AS REQUIRED)

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FORM OF CONTRACTOR'S ROOFING GUARANTEE

(Contractor refers to General and/or Roofing Contractor, jointly and severably)

Name of
Project _____

Location _____

Owner _____

General Contractor _____ Roofer _____

Address _____ Address _____

_____ _____

EFFECTIVE DATES OF GUARANTEE:

Date of Acceptance _____ Date of Expiration _____

A. The Contractor does hereby certify that the roofing work included in this contract was installed in strict accordance with all requirements of the plans and specifications and in accordance with approved roofing manufacturers recommendations.

B. The Contractor does hereby guarantee the roofing and associated work including but not limited to all flashing and counter flashing both composition and metal; roof decking and/or sheathing; all material used as a roof substrate or insulation over which roof is applied; promenade decks or any other work on the surface of the roof; metal work; gravel stops and roof expansion joints to be absolutely watertight and free from all leaks, due to faulty or defective materials and workmanship for a period of five (5) years, starting on the date of substantial completion of the project. This guarantee does not include liability for damage to interior contents of building due to roof leaks, nor does it extend to any deficiency which was caused by the failure of work which the Contractor did not damage or did not accomplish or was not charged to accomplish.

C. Subject to the terms and conditions listed below, the Contractor also guarantees that during the Guarantee Period he will, at his own cost and expense, make or cause to be made such repairs to, or replacements of said work, in accordance with the roofing manufacturers recommendations as are necessary to correct faulty and defective work and/or materials which may develop in the work including, but not limited to: blisters, delamination, exposed felts, ridges, wrinkles, splits, warped insulation and/or loose flashing, etc. in a manner pursuant to the total anticipated life of the roofing system and the best standards applicable to the particular roof type in value and in accordance with construction documents as are necessary to maintain said work in watertight conditions, and further, to respond on or within three (3) calendar days upon proper notification of leaks or defects by the Owner or Architect.

1. Specifically excluded from this Guarantee are damages to the work, other parts of the building and building contents caused by: (1) lightning, windstorm, hailstorm and other unusual phenomena of the elements; and (2) fire. When the work has been damaged by any of the foregoing causes, the Guarantee shall be null and void until such damage has been repaired by the Contractor, and until the cost and expense thereof has been paid by the Owner or by the responsible party so designated.

2. During the Guarantee Period, if the Owner allows alternation of the work by anyone other than the Contractor including cutting, patching and maintenance in connection with penetrations, and positioning of anything on the roof, this Guarantee shall become null and void upon the date of said alterations. If the Owner engages the Contractor to perform said alterations, the Guarantee shall not become null and void, unless the Contractor, prior to proceeding with said work, shall have notified the Owner in writing, showing reasonable cause for claim that said alterations would likely damage or deteriorate the work, thereby reasonably justifying a termination of this Guarantee.

3. Future building additions will not void this guarantee, except for that portion of the future addition that might affect the work under this contract at the point of connection of the roof areas, and any damage caused by such addition. If this contract is for roofing of an addition to an existing building, then this guarantee covers the work involved at the point of connection with the existing roof.

4. During the Guarantee Period, if the original use of the roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray cooled surface, flooded basin, or other use of service more severe than originally specified, this Guarantee shall become null and void upon the date of said change.

5. The Owner shall promptly notify the Contractor of observed, known or suspected leaks, defects or deterioration, and shall afford reasonable opportunity for the Contractor to inspect the work, and to examine the evidence of such leaks, defects or deterioration.

D. Standard manufacturer's roofing guarantees which contain language regarding the governing of the guarantee by any state other than the state of Alabama, must be amended to exclude such language, and shall substitute the requirement that the Laws of the State of Alabama shall govern all such guarantees.

IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, 20____.

_____	_____
General Contractor's Authorized Signature	Roofing Contractor's Authorized Signature
_____	_____
Typed Name and Title	Typed Name and Title

APPLICATION AND CERTIFICATE FOR PAYMENT FORM

1.1 Application for Payment shall be executed on AIA Document G702 Contractor's Application for Payment, along with AIA Document G703 Continuation Sheet. A draft copy is attached for reference. Copies of G702 and G703 are available for viewing in the office of the Architect, and may be purchased from an AIA documents vendor by the Contractor.

END OF APPLICATION AND CERTIFICATE FOR PAYMENT FORM

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AIA® Document G702® – 1992

Application and Certificate for Payment

TO OWNER:	**PROJECT:**	**APPLICATION NO:**	**Distribution to:**
			OWNER : [ ]
		PERIOD TO:	ARCHITECT : [ ]
		CONTRACT FOR:	CONTRACTOR : [ ]
FROM	**VIA**	**CONTRACT DATE:**	FIELD : [ ]
CONTRACTOR:	**ARCHITECT:**	**PROJECT NOS:** / /	OTHER : [ ]

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract.
AIA Document G703®, Continuation Sheet, is attached.

1. ORIGINALCONTRACT SUM.....	0.00
2. NET CHANGE BY CHANGE ORDERS.....	0.00
3. CONTRACT SUM TO DATE(Line 1 ± 2).....	0.00
4. TOTAL COMPLETED & STORED TO DATE(Column G on G703).....	0.00
5. RETAINAGE:	
a. 0.00% of Completed Work (Column D + E on G703: 0.00)=	0.00
b. 0.00% of Stored Material (Column F on G703: 0.00)=	0.00
Total Retainage (Lines 5a + 5b or Total in Column I of G703).....	0.00
6. TOTAL EARNED LESS RETAINAGE..... (Line 4 Less Line 5 Total)	0.00
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT..... (Line 6 from prior Certificate)	0.00
8. CURRENT PAYMENT DUE.....	0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6)	0.00

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	0.00	0.00
Total approved this Month	0.00	0.00
TOTALS	0.00	0.00
NET CHANGES by Change Order		0.00

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

State of:

County of:

Subscribed and sworn to before me this day of

Notary Public:

My Commission expires:

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED..... 0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

DRAFT

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AIA® Document G703® – 1992

Continuation Sheet

AIA Document G702®, Application and Certification for Payment, or G732™,
Application and Certificate for Payment, Construction Manager as Adviser Edition,
containing Contractor's signed certification is attached.
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO:

APPLICATION DATE:

PERIOD TO:

ARCHITECT'S PROJECT NO:

A	B	C	D	E	F	G		H	I
			WORK COMPLETED						
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	FROM PREVIOUS APPLICATION (D + E)	THIS PERIOD	MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D + E + F)	% (G÷C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
	GRAND TOTAL	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00%**	**0.00**	**0.00**

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INVENTORY OF STORED MATERIALS

Project: **HOUSTON COUNTY DEPARTMENT OF HUMAN RESOURCES**
DOTHAN, AL

For Estimate No. _____

For Period Ending _____

Contractor:

GM&C Project No. ABHM250019

A	B	C	D	E	F
DESCRIPTION	MATERIALS STORED LAST PERIOD	PURCHASED THIS PERIOD	TOTAL COLUMNS B + C	MATERIALS USED THIS PERIOD	MATERIALS PRESENTLY STORED

To be used as documentation to support value of Stored Materials reported on APPLICATION AND CERTIFICATE FOR PAYMENT.

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PROGRESS SCHEDULE AND REPORT

CONTRACTOR:

DATE OF REPORT:

PROJECT: HOUSTON COUNTY DHR
DOTHAN, ALABAMA

PROCEED DATE:

ARCHITECT: GOODWYN MILLS CAWOOD, LLC.
2400 5th Ave., S., Suite 200
Birmingham, Alabama 35233

PROJECT NO.: ABHM250019

PROJECTED COMPLETION DATE:

WORK DIVISION	%	AMOUNT													≥ MONTH
1. GENERAL REQUIREMENTS															
2. SITEWORK															
3. CONCRETE															
4. MASONRY															
5. METALS															
6. WOOD AND PLASTICS															---100%
7. THERMAL AND MOISTURE PROTECTION															-----90%
8. DOORS AND WINDOWS															-----80%
9. FINISHES															-----70%
10. SPECIALTIES															-----60%
11. EQUIPMENT															-----50%
12. FURNISHINGS															-----40%
13. SPECIAL CONSTRUCTION															-----30%
14. CONVEYING SYSTEMS															-----20%
15. MECHANICAL															-----10%
16. ELECTRICAL															------0%
TOTAL ORIGINAL CONTRACT	100%														
ANTICIPATED DRAW IN $1,000's															
ACTUAL DRAW IN $1,000's															

LEGEND: ANTICIPATED ACTIVITY — ACTUAL ACTIVITY — ANTICIPATED CASH FLOW — ACTUAL CASH FLOW

USE ADDITIONAL SHEET IF JOB IS SCHEDULED MORE THAN 12 MONTHS

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CHANGE ORDER FORM

1.1 Changes to the Contract shall be made using AIA Document G701 Change Order. A draft copy is attached for reference. Copies of G701 are available for viewing in the office of the Architect, and may be purchased from an AIA documents vendor by the Contractor.

END OF CHANGE ORDER FORM

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AIA® Document G701® – 2017

Change Order

PROJECT: *(Name and address)*	**CONTRACT INFORMATION:** Contract For: Date:	**CHANGE ORDER INFORMATION:** Change Order Number: Date:
OWNER: *(Name and address)*	**ARCHITECT:** *(Name and address)*	**CONTRACTOR:** *(Name and address)*

THE CONTRACT IS CHANGED AS FOLLOWS:
(Insert a detailed description of the change and, if applicable, attach or reference specific exhibits. Also include agreed upon adjustments attributable to executed Construction Change Directives.)

The original was	$ 0.00
The net change by previously authorized Change Orders	$ 0.00
The prior to this Change Order was	$ 0.00
The will be unchanged by this Change Order in the amount of	$ 0.00
The new including this Change Order will be	$ 0.00

The Contract Time will be unchanged by ( ) days.
The new date of Substantial Completion will be

NOTE: This Change Order does not include adjustments to the Contract Sum or Guaranteed Maximum Price, or the Contract Time, that have been authorized by Construction Change Directive until the cost and time have been agreed upon by both the Owner and Contractor, in which case a Change Order is executed to supersede the Construction Change Directive.

NOT VALID UNTIL SIGNED BY THE ARCHITECT, CONTRACTOR AND OWNER.

ARCHITECT *(Signature)*	**CONTRACTOR** *(Signature)*	**OWNER** *(Signature)*
(Printed name, title, and license number if required)	*(Printed name and title)*	*(Printed name and title)*
Date	*Date*	*Date*

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User Notes: (67d9d181ab647ddddca97dd3)

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CERTIFICATE OF SUBSTANTIAL COMPLETION FORM

1.1 Certificate of Substantial Completion shall be executed using AIA Document G704 Certificate of Substantial Completion. A draft copy is attached for reference. Copies of G704 are available for viewing in the office of the Architect, and may be purchased from an AIA documents vendor by the Contractor.

END OF CERTIFICATE OF SUBSTANTIAL COMPLETION FORM

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AIA® Document G704® – 2017

Certificate of Substantial Completion

PROJECT: *(name and address)*	**CONTRACT INFORMATION:** Contract For: Date:	**CERTIFICATE INFORMATION:** Certificate Number: Date:
OWNER: *(name and address)*	**ARCHITECT:** *(name and address)*	**CONTRACTOR:** *(name and address)*

The Work identified below has been reviewed and found, to the Architect's best knowledge, information, and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated below is the date established by this Certificate.
(Identify the Work, or portion thereof, that is substantially complete.)

ARCHITECT *(Signature)*	*(Printed name, title, and license number if required)*	*Date Of Substantial Completion*

WARRANTIES
The date of Substantial Completion of the Project or portion designated above is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:
(Identify warranties that do not commence on the date of Substantial Completion, if any, and indicate their date of commencement.)

WORK TO BE COMPLETED OR CORRECTED
A list of items to be completed or corrected is attached hereto, or transmitted as agreed upon by the parties, and identified as follows:
(Identify the list of Work to be completed or corrected.)

The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment, whichever occurs first. The Contractor will complete or correct the Work on the list of items attached hereto within ( ) days from the above date of Substantial Completion.

Cost estimate of Work to be completed or corrected: $

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work, insurance, and other items identified below shall be as follows:
(Note: Owner's and Contractor's legal and insurance counsel should review insurance requirements and coverage.)

The Owner and Contractor hereby accept the responsibilities assigned to them in this Certificate of Substantial Completion:

CONTRACTOR *(Signature)*	*(Printed name and title)*	*Date*

OWNER *(Signature)*	*(Printed name and title)*	*Date*

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User Notes: (67d9d1ed1721eb2ecf0193f7)

ADVERTISEMENT FOR COMPLETION FORM

LEGAL NOTICE

In accordance with Chapter 1, Title 39, Code of Alabama, 1975, as amended, notice is hereby given that

_____,
(*Name of Contractor*)

has completed the Contract for Construction of

_____
(*Name of Project*)

_____
(*Insert location data in County or City*)

for the _____,Owner(s), and have made request for final settlement of said Contract. All persons having any claim for labor, materials, or otherwise in connection with this project should immediately notify

GOODWYN MILLS CAWOOD, LLC.
2400 5th Avenue South, Suite 200
Birmingham, Alabama 35233
(*Architect*)

_____
(*Name of Contractor*)

_____
(*Business Address*)

_____

NOTE: This notice must be run once a week for four successive weeks in the County where the project is located for projects exceeding $50,000.00. For projects of less than $50,000.00, run one time only. Proof of publication is required, by submittal of certified ad copy in duplicate.

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HOUSTON COUNTY
DEPARTMENT OF HUMAN RESOURCES

DOTHAN, ALABAMA

COMPLETED 20__

FOR THE
THE HOUSTON COUNTY PUBLIC BUILDING AUTHORITY

Name	**Title**
Name	**Title**
Name	**Title**
Name	**Title**
Name	**Title**

(Note: Obtain Names and Titles before fabricating.)

GOODWYN MILLS CAWOOD, LLC. ARCHITECT
Birmingham, Alabama

(Contractor's Name) CONTRACTOR
(Contractor's City & State)

Notes: 1. Refer to Section 10 1400 - "Signage", for additional information and requirements.
2. Approximate Size: 22-inches wide x 28-inches high.
3. Verify names, titles, and date before fabrication.

PLAQUE DETAIL – 1 REQUIRED

NOT TO SCALE

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HOUSTON COUNTY
DEPARTMENT OF HUMAN RESOURCES
DOTHAN, AL

ENFRA TME, LLC Project # 12-25-0053
Client Project # ABHM250019

Index

DIVISION 21 FIRE PROTECTION SPECIFICATIONS

Section 21 0451 General Fire Protection Requirements
Section 21 0452 Identification for Fire Protection Piping and Equipment
Section 21 0453 Basic Fire Protection Materials and Methods
Section 21 0455 Fire Protection System

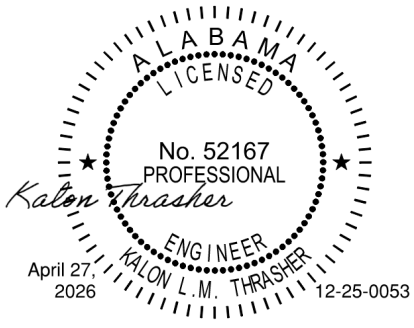
DIVISION 22 PLUMBING SPECIFICATIONS

Section 22 0401 General Plumbing Requirements
Section 22 0403 Basic Plumbing Materials and Methods
Section 22 0405 Identification for Plumbing Piping and Equipment
Section 22 0407 Plumbing Systems Insulation
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DIVISION 23 HEATING VENTILATING AND AIR CONDITIONING SPECIFICATIONS

Section 23 0010 General HVAC Requirements
Section 23 0053 Basic HVAC Materials and Methods
Section 23 0054 Variable Frequency Drives
Section 23 0062 Hangers and Supports for HVAC Piping and Equipment
Section 23 0077 Identification for HVAC Piping and Equipment
Section 23 0122 Meters and Gages
Section 23 0183 Refrigerant Piping
Section 23 0513 Common Motor Requirements for HVAC Equipment
Section 23 0629 Scroll Water Chillers – Packaged Air Cooled
Section 23 0712 HVAC Systems Insulation
Section 23 0725 Custom Indoor AHU's
Section 23 0738 Mini Split System AC Units
Section 23 0762 Unit Heaters
Section 23 0775 Electric Heating Cables
Section 23 0820 Duct Accessories
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Section 23 0840 Air Terminal Units
Section 23 0855 Air Outlets and Inlets
Section 23 0900 HVAC Instrumentation and Controls
Section 23 0950 Testing, Adjusting and Balancing
Section 23 2113 Hydronic Piping
Section 23 2114 Hydronic Specialties
Section 23 3113 Metal Ducts





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SECTION 01 0150
SPECIAL CONDITIONS

1.01 TIME FOR COMPLETION OF WORK:

A. The Contractor may proceed to award sub-contracts, assemble materials, etc., after written "Notice To Proceed" with Work is given by the Owner. The Contractor's official time for construction to start on work shall be the date of the Owner's written "Notice to Proceed" with Work; and completion of the Work shall be within the number of consecutive calendar days or by the date(s) indicated on the Contractor's Proposal Form.
   1. Properly supervised work, per requirements, will be permitted on Saturdays and Sundays.

B. Acceptance of the completed Work of this Contract will be at a single date, and not in phases, unless otherwise indicated.

C. All Work of this Contract shall be substantially complete within **FOUR HUNDRED EIGHTY (480)** consecutive calendar days from the Owner's official written Notice to Proceed.

D. Nothing in the Contract Documents shall permit or be construed to permit payment to the Contractor for any extended overhead or profit due to completion of the project extending beyond the Contractual completion date. In no event shall the Owner or Architect be liable to the Contractor for damage due to any delay to any portion of the Work of this Contract.

E. Delays: See Article 8.3, and related articles of AIA General Conditions.

1.02 LIQUIDATED DAMAGES:

A. Actual damages for delay in completion may be impossible to determine, and the Contractor shall be liable for and the Owner shall deduct as liquidated damages from the final payment due the Contractor, the following, in addition to 6% per annum of the total contract amount:
   1. For each calendar day of delay in completion of any part of the work beyond the number of days specified, the sum of $250.00.
   2. In the event that work on this project is incomplete and ongoing after the contractual completion date, beginning at ten (10) additional days thereafter, the Owner will also charge the Contractor, an additional $250.00 per day, for the Owner's nominal reimbursement to the Architect for continued work on the project, which charges will continue until "Substantial Completion" is accomplished.

B. The submittal of a Bid and/or Proposal by any Contractor and their Subcontractors shall be construed as, in part, acknowledgement and acceptance of these provisions.

1.03 SITE RESTRICTIONS:

A. The limits of work and known restrictions are indicated on the Site Plan and various portions of the Drawings and the Project Manual.
   1. Refer also to Section 01 1000 - "Summary of The Work," for additional information and requirements.

1.04 PRE-BID CONFERENCE:

A. Refer to "Advertisement for Prequalification and Bids" for additional information and requirements.

1.05 PRE-CONSTRUCTION CONFERENCES:

A. Refer to Section 01 3000 - "Administrative Requirements".

1.06 PRE-ROOFING CONFERENCE:

A. A pre-roofing conference is required before any roofing materials are installed. This conference shall be conducted by a representative of the Architect and attended by representatives of the Owner, General Contractor, Roofing Contractor, Sheet Metal Contractor, Roof Deck Manufacturer (if applicable) and the Roofing Materials Manufacturer (if warranty is required of

this manufacturer). If equipment of substantial size is to be placed on the roof, the Mechanical Contractor must also attend this meeting.

B. The pre-roofing conference is intended to clarify demolition (for renovation or re-roofing projects) and application requirements for work to be completed before roofing operations can begin. This would include a detailed review of the specifications, roof plans, roof deck information, flashing details and approved shop drawings, submittal data, and samples. If conflict exists between the specifications and the Manufacturer's requirements, this shall be resolved. If this pre-roofing conference cannot be satisfactorily concluded without further inspection and investigation by any of the parties present, it shall be reconvened at the earliest possible time to avoid delay of the work. In no case should the work proceed without inspection of all roof deck areas and substantial agreement on all points.

C. The following are to be accomplished during the conference:
   1. Review all Factory Mutual and Underwriters Laboratories requirements listed in the specifications and resolve any questions or conflicts that ay arise.
   2. Establish trade-related job schedules, including the installation of roof-mounted mechanical equipment.
   3. Establish roofing schedule and work methods that will prevent roof damage.
   4. Require that all roof penetrations and walls be in place prior to installing the roof.
   5. Establish those areas on the job site that will be designated as work and storage areas for roofing operations.
   6. Establish weather and working temperature conditions to which all parties must agree.
   7. Establish acceptable methods of protecting the finished roof if any trades must travel across or work on or above any areas of the finished roof.

D. The Architect shall prepare a written report indicating actions taken and decisions made at this pre-roofing conference. This report shall be made a part of the project record and copies furnished the General Contractor, and the Owner.

E. Refer to Section 01 3000 - "Administrative Requirements" for additional information and requirements.

1.07 CONTRACTOR ACCESS TO SITE:

A. The Contractor will have access to the site immediately upon receipt of the Owner's written Notice to Proceed with work. All routes of access to the site and gate locations by the Contractor or their subcontractors, are subject to approval by Owner, Architect, and other authorities having jurisdiction. Check site plan for location of work limits. Refer to Section 01 1000 - “Summary of The Work” and Section 01 5000 - “Temporary Facilities,” for additional information and requirements.

B. The Contractor shall be required to coordinate the Work of the project with the Owner’s activities, to the extent that the Work of this Contract has little or no effect on normal operations.

1.08 CONTRACTOR’S PLAN FOR CONSTRUCTION OF PROJECT:

A. Contractor shall prepare and submit within 7 days from award of contract to the Architect for review and approval a Bar Graph, indicating his proposed plan and sequence of operations to complete each phase of this project, on schedule as required by contract. This Bar Graph is expected to be a Critical Path graph.
   1. Schedule should identify project milestones and expected durations.

B. Refer to Section 01 3216 - "Construction Progress Schedule" for additional information and requirements.

1.09 CONTRACTOR JOB MEETINGS:

A. On-Site Meetings with Architect , and various trades, general contractors and subcontractors, shall be conducted by the Contractor as directed by the Architect for purpose of furthering the progress of the work, solving construction problems, and issuing instructions.

B. Refer to “Pre-construction Conferences” paragraph above, “General Conditions of the Contract”, and Section 01 3000 - "Administrative Requirements" for additional information and requirements.

1.10 STORED MATERIALS:

A. It is recognized that the size of the site is restrictive and that it may be necessary for the Contractor to store some materials for project at locations on the site, prior to removal or disposal. When such on site storage is necessary, comply with requirements of authorities having jurisdiction, including in part, on site retention of earth, storm water run-off, slopes of debris, earth, etc.

B. Store items to be incorporated in the Work in stable and secure manner, off of ground, separated by hardwood or treated wood blocking, and under cover or in storage building.
   1. Any materials found stored directly on ground or paving, in standing water, etc., will be rejected, immediately removed from site, and replaced with new materials at the Contractor’s expense.
   2. Distribute materials around framing and the roof in such manner as to prevent any damage to structure, construction, improvements, etc.

C. Refer to Section 01 6000 - “Product Requirements”, for additional information and requirements for any off-site stored materials.

1.11 PROTECTION:

A. The Contractor shall provide and maintain adequate fencing and barricades, where indicated, and wherever required. Building entrances and exits shall remain unobstructed at all times when buildings are occupied.

B. The Contractor shall provide suitable protection for all employees, the public, students, children, users of other adjacent facilities, and the occupants of existing buildings at all times during the execution of and until the completion of the Work.
   1. Construction equipment shall not come in contact with or swing over existing facilities to remain, public areas, occupied buildings, right-of-ways, etc., which are to remain.

C. The Contractor shall avoid damage as a result of their operations, to the existing buildings, walks, pavement, curbs, grass, shrubbery, trees, utilities, adjoining property, etc., and shall at his/her own expense, completely repair any damage thereto caused by his operations. All repair work is subject to Architect’s approval, and that of its Owner.

D. Refer to Section 01 5000 - "Temporary Facilities and Controls" for additional information and requirements.

1.12 WORK LIMITS PROTECTION:

A. The Contractor shall locate all temporary buildings, storage of equipment, materials, etc., within a protected area to protect the public, and others from the construction activities. Type and location of such protection shall be as existing at the site, or if not existing or complete, as proposed and furnished by the Contractor, subject to acceptance of the Architect, Owner, and authorities having jurisdiction.

B. Refer to Section 01 5000 - "Temporary Facilities and Controls" for additional information and requirements.

1.13 EMPLOYMENT OF AND PAYMENT FOR TESTING SERVICES:

A. The following information regarding Employment of and Payment for Testing Services under the work of Specifications shall take precedence over any conflicting statements otherwise, which may have remained in the Project Manual after editing:
   1. Initial testing required by the Contract Documents for Divisions 2 through 5, and Divisions 31-33 (except not utility systems testing) shall be provided by an independent testing agency selected, employed and paid by the Owner.

2. Initial testing required by the Contract Documents for all other testing and Divisions 6 through 26 shall be provided by a testing agency acceptable to the Owner, and selected, employed, and paid by the Contractor from his/her Contract amount.
3. Any retesting required (due to failure of initial testing to meet the requirements of the Contract Documents) shall be at the Contractor's expense.
4. Any retesting required (due to questionable materials or construction methods, for verification purposes, and etc.) shall be at the Contractor's expense when the results of such retesting indicate any work or materials do not comply with requirements of the Contract Documents. Otherwise, such retesting will be at Owner's expense.
5. Any retesting under the above provisions shall be performed by the same Owner accepted testing agency.
6. Nothing in the Contract Documents shall prevent the Contractor from performing any other or additional Quality Control testing at his/her own expense, to verify compliance with the Bid and Contract Documents.

B. The Contractor shall be responsible for contacting and directions to the accepted testing agency and for any follow-up communications required, for all testing required by the Contract Documents.

C. No unsuitable or unsatisfactory existing soils or building materials (other than work in Contract) shall be removed without either the presence of or concurrence of and prior approval of the Architect and the accepted testing agency, so as to assure quality of the Work is maintained, and to verify quantities of any additional work under bid "Unit Prices", for which the Contractor is due payment by the Owner.

D. The Contractor shall be responsible for contacting and directions to the accepted testing agency and for any follow-up communications required, for all testing required by the Contract Documents.

E. Refer to Section 01 4000 - "Quality Requirements" for additional information and requirements.

1.14 PROHIBITED MATERIALS:

A. ASBESTOS: All materials, equipment, components, accessories, and etc., installed in the work of this contract, both field installed and bought-out manufactured items from any source shall be 100-percent free of asbestos.

B. LEAD CONTENT: All water-bearing lines, water dispensing equipment, finish materials, and paint other than exposed exterior roof flashings, shall be 100-percent free of lead.

C. CALCIUM CHLORIDE: Calcium chloride and/or derivatives or additives thereof shall not be permitted in any concrete, concrete product, grout, masonry and/or mortar.

D. ENVIRONMENTAL REGULATIONS: All materials, their application, installation, and completion, shall comply with applicable environmental regulations, including in part, erosion, air-borne contaminants, and volatile organic compounds (VOC's).

E. FORMALDEHYDE: All insulation and other products shall be 100-percent free of formaldehyde.

1.15 PROHIBITED EQUIPMENT:

A. The elevated and framed floor slabs are not designed to accommodate heavy rolling point loads. Scissor lifts are not permitted on any elevated or framed slab during the construction of the project.

1.16 PERSONNEL EXPERIENCE AND SUPERINTENDENTS:

A. Subcontractors shall have no less than 5-years verifiable experience in their trade and no less than 5-years verifiable experience in their business enterprise contracting for work under this project; The type of work subcontracted for this project shall be the principal business of the Subcontractor.

B. Superintendents and foremen, or other individual in the lead or supervisory position for any portion of the Work under this Contract shall have no less than 7-years verifiable experience in performing the type of work they are responsible for.
   1. The Contractor shall submit resumes of work and project experience for their Superintendent and foremen, as soon as possible and at least within five calendar days of receipt of the Contract to be executed for the work, for review and acceptance by the Owner and Architect.
   2. If the Superintendent is replaced on the job after work begins, the same qualifications as above apply. Submit for review and acceptance by the Owner and Architect.

1.17 SUBMITTALS:

A. Submittal requirements are indicated throughout the Contract Documents, and the following supplements those requirements.
   1. Contractor will be required to make submittals for every item and product so indicated; Also upon request, for any additional or other item or products intended for use or incorporation in the Work.

      a. The Contractor shall submit to the Architect within 30 days of “Notice to Proceed”, a complete listing of all required submittals, warranties, guarantees, close-out documents, and materials requiring extra or “attic” stock delivered to the Owner, for review and acceptance. Include for each item, the anticipated date of Submittal to the Architect. Re-submit until accepted or approved.
   2. The Contractor shall review, mark all necessary changes, revisions, and questions; and then stamp, sign, approve, and submit to the Architect, all Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, and shall do so with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner, or of separate contractors.
      a. The Contractor shall not make submittals to the Architect which they have not reviewed, stamped, signed and approved by the Contractor; or in such case, no action will be taken by the Architect or their Consultants regarding that or those submittals.
   3. The Contractor shall submit number of copies for review as indicated in Section 01 3000 - Administrative Requirements.
   4. Review time will be limited to two weeks, except for more complex submittals, such as Structural, and Divisions 21-26.
   5. Colors will not be selected until most or all submittals required have been received and reviewed. Actual color chip samples shall be required along with standard color selection paperwork. No exceptions.
   6. Samples: Submit the number specified in Section 01 3000.
   7. Submit test reports as required or otherwise requested, in the same quantity as other submittal data.
   8. Contractor shall provide letter from Mechanical Contractor stating the Mechanical Contractor has coordinated all power requirements with the Electrical Contractor. Mechanical submittals will not be reviewed without receipt of this letter.
   9. Contractor shall distribute reviewed submittals to all concerned and appropriate Subcontractors and Suppliers.
   10. Contractor shall maintain 1-set of reviewed and approved submittals at his on-site job office.

B. Review and/or approval of submittals by the Architect, Owner and/or their Consultants shall not relieve the Contractor of his responsibility to comply with the requirements of the Contract Documents.
   1. Any proposed change in the Work shall be submitted separate from any other item during construction, with same documentation as pre-bid requests, or they will not be considered.
   2. No actual or proposed change shall be included in Shop Drawings or other Construction submittals, and none so included will be considered approved under any circumstances.

3. Shop Drawings are communications between the Contractor and various suppliers, fabricators, and subcontractors. The design professional's role is to review the drawings to answer questions that arise about design intent.
4. Even if a reviewed Shop Drawing or other Submittal has deviations from the original design and the Contract Documents, it in itself is not a Change Order and it is not, IN ITSELF, an approval of the change. Changes can only be approved by Change Order.
5. Dimensions, quantities, and coordination remain the Contractor's responsibility.

C. Refer to Section 01 3000 - "Administrative Requirements" for additional information and requirements.

1.18 SITE MAINTENANCE:

A. The Owner will require all mud or debris resulting from this construction to be removed from streets, sidewalks, etc., by the Contractor as it appears, one or more times daily.

B. Trash, debris, etc., must be removed from the site as Contractor's trash cans, waste receptacles, etc., are filled. Same will not be allowed to accumulate or blow around the site, within the buildings, etc.

C. The Contractor shall be responsible for maintaining existing landscaping and lawns within and below any construction fencing, for the duration of the Work of the Contract, or until any such fencing is removed.

D. Refer to Sections 01 1000, 01 5000, 01 7000 and other locations in the Bid and Contract Documents for additional information and requirements.

1.19 INSURANCE AND SPECIAL PROVISIONS:

A. The Contractor and their insurer, by execution of the Contract, shall waive all rights of subrogation against "the Owner, the Architect, and their Consultants", and same shall be indicated on all insurance provided by the Contractor and each Subcontractor.

B. The Contractor and their insurer, and each Subcontractor, shall name "the Owner, Architect, and their Consultants", as additional named primary insureds on all insurance provided by the Contractor and each Subcontractor, except not for "Workers Compensation and Employers Liability".

C. Refer to "General Conditions" and other portions of the Bid and Contract Documents, for additional information and insurance requirements. Note that Builder's Risk insurance is required, as described in "General Conditions", as modified by "Supplementary Conditions".
1. Extent of coverage required and/or any approval or acceptance of the insurance carried shall not act to modify the liability of the Contractor, nor to imply that the limits, features and/or coverages described are adequate to protect the interests or exposures of the Contractor.

D. The Contractor shall "hold harmless" and indemnify the Owner, Architect, and their Consultants from any claim or legal action resulting from any circumstances related to the Work of this project, including in part, payment of any legal or other expenses, fines, judgments, etc.

E. Insurance policies required by the Contract Documents shall not be canceled, altered, or changed, without first having given thirty (30) days written notice to the Owner, with a copy sent to the Architect, except ten(10) days written notice for non-payment of premium.
1. Copies of all policies, endorsements, and insurance certificates, including new, renewed, altered, and/or changed during this Contract shall be delivered to the Owner within ten (10) days of effective date(s), with a copy sent to the Architect, by the Contractor.

F. Refer to General Conditions of the Contract for additional information and requirements regarding minimum insurance and indemnity requirements.

G. Special Provision: Nothing in this or other paragraphs of the Contract Documents shall create or give to third parties any claim or right of action beyond such as may legally exist irrespective of the Contract.

1.20 ACCESSIBILITY OF ALL COMPLETED WORK:

A. All products and installations of the Work of this Contract, shall be as designed by the fabricator, manufacturer, etc., and installed by the Contractor, Subcontractors, etc., so as to provide full accessibility to the handicapped and/or disabled, unless specifically indicated otherwise. This shall include in part, the following:
   1. Mounting heights of all electrical devices, switches, etc., all designated plumbing fixtures, and their operation, in all areas except mechanical and electrical rooms, and service areas which are not accessible at any time to the public or Owner's administrative (not service or maintenance) personnel.
   2. Signage.
   3. Door operation and hardware.
   4. Elevator (if any).
   5. Slip resistance of all completed flooring and walkway surfaces both interior and exterior.

B. Comply with the more stringent requirements of at least the following, either the latest edition or latest adopted edition of the locality, and all revisions and amendments thereto:
   1. Uniform Federal Accessibility Standards (UFAS).
   2. Americans With Disabilities Act of 1990 (ADA) "Accessibility Guidelines" (ADA-AG), and all revisions and amendments thereto.
   3. American National Standards Institute (ANSI), ANSI A 117.1.
   4. U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA "Accessibility Guidelines" (ADA-AG), Published in the Federal Register July 23, 2004, and revisions and amendments thereto.
   5. International Building Code, as applicable at the project locale.

1.21 CONTRACTOR PROGRAMS AND CONDUCT OF PERSONNEL:

A. The Contractor shall implement programs and make literature available to all construction and administration personnel to encourage making this project a safe place to work, including in part the following requirements: A project site free of any substance abuse, which does not allow any consumption of alcohol, and which does not allow any work to be performed while under the influence of any debilitating substance.
   1. The Contractor and every Subcontractor shall have as part of their personnel, safety, substance abuse prevention, and/or quality programs, mandatory drug testing at pre-employment, post-accident, and at random during employees' tenure with their firms. Each such entity shall be prepared to provide non-confidential verification to the Owner that such testing is consistently on-going, upon Owner's request for same.

B. Programs shall be as acceptable to or recommended by one or more of the following:
   1. Contractor's Underwriter for Worker's Compensation or liability insurance.
   2. OSHA.
   3. Associated General Contractors.
   4. U.S. Department of Defense, Corps of Engineers, or Veterans Administration.

C. Conduct of all personnel employed for the Work of this project shall be held to a high standard and shall not be offensive to others on or around the site, including in part, pedestrians, the public, the Owner, Owner's Consultants, etc.
   1. The Contractor and their employees shall limit any discussion of the Work of this project to the Owner's representative named in the front of this Project Manual, inspecting authorities with jurisdiction, and the Architect; In no instance shall this project be discussed with others, except as may otherwise be indicated herein.

   2. The Contractor's personnel and Subcontractors shall not enter the Owner's building, nor use the Owner's telephones (except in emergencies), or the Owner's restrooms.

D. The Contractor shall immediately dismiss and escort off of the project site, any personnel who are obviously under the influence of alcohol or other debilitating substance, and any personnel

exhibiting offensive behavior as described above or by law or by local statute or regulations of authorities having jurisdiction.

1.22 WORK BY OTHERS:

A. The following items of work are to be provided by others, and are Not in Contract (N.I.C.). The Contractor will be required to coordinate with the Owner as necessary to accommodate provisions for these items.
   1. Movable furniture, furnishings, office equipment, library equipment, and movable library shelving unless otherwise indicated.
   2. Listed Equipment, residential appliances, and items of Alternate work not accepted at this time, and/or indicated “Not In Contract”, “N.I.C.”, “Future”, and/or similar indication.
      a. Unless otherwise indicated, coordination, locating, and providing rough-ins for all power, water supply, gas, drains, drain lines, condensate drain outlet, and other utilities required for such equipment, casework, etc., and preparation required for the addition of future finishes (same as level of finish required for the finishes included in Bid, just prior to finishes being added), shall be included in Base Bid;

B. Refer to Section 01 1000 - "Summary of The Work" for additional information and requirements.

1.23 SELECTIVE DEMOLITION:

A. Section 02 4100 - “Demolition,” is applicable to the entire Work of this project and not just to Division 2 where it occurs.

1.24 INSPECTIONS:

A. See Section 01 3000 - Administrative Requirements for information on Scheduling of Inspections, and Minimum Requirements for Required Inspections.

1.25 USER FEES:

A. The Contractor is hereby advised that, if applicable, any administrative fees in the form of a Permit Fee shall be paid by the Contractor.

END OF SECTION

SECTION 01 1000
SUMMARY OF THE WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND GENERAL INFORMATION

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to work of this section.

1.02 PROJECT/WORK IDENTIFICATION

A. General: Project name is "HOUSTON COUNTY DEPARTMENT OF HUMAN RESOURCES, for THE HOUSTON PUBLIC BUILDING AUTHORITY, DOTHAN, ALABAMA", as shown on the Contract Documents prepared by Goodwyn Mills Cawood, LLC., dated November 14, 2025.

B. Contract Documents indicate the work of the Contract and related requirements and conditions that have an impact on the project.

C. Summary by References: Work of the Contract can be summarized by references to the Contract, General Conditions, Supplementary Conditions (if any), the Project Manual, Technical Specification Sections, Drawings, Addenda and modifications to the Contract Documents issued subsequent to the initial printing of this Project Manual and the Drawings, and including but not necessarily limited to printed material referenced by any of these. It is recognized that the Work of the Contract is also unavoidably affected or influenced by governing regulations, natural phenomenon including weather conditions, and other forces outside the contract documents.

D. Abbreviated Written Summary: Briefly and without force and effect upon the contract documents, the Work of the Contract can be summarized as follows:
   1. The Work includes construction of new building, and related work, as required to complete the facilities as indicated on the Drawings and in the Project Manual.

1.03 CONTRACTOR USE OF PREMISES

A. General: During the entire construction period the Contractor shall have the exclusive use of the premises for construction operations, including full use of the site as shown on the Drawings.
   1. Limitations of exclusive use of the site:
      a. Confine operations at the site to the areas permitted under the Contract. Portions of the site beyond areas on which work is indicated are not to be disturbed. Conform to applicable rules and regulations affecting the work while engaged in project construction. See site plan for egress and ingress to site, or if not indicated, same shall be as designated by the Owner.
      b. Keep existing public roads, driveways and entrances serving the premises clear and available at all times. Do not use these areas for parking or storage of materials. Remove dirt, mud, debris, etc., from site, sidewalks, streets, and public right-of-way as it occurs.
      c. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage sheds to the areas indicated. If additional storage is necessary, obtain and pay for such storage off site in a fully bonded and insured facility acceptable to the Owner, with all items stored clearly identified as being assigned to this project.
      d. Lock automotive type vehicles, such as passenger cars and trucks and other mechanized or motorized construction equipment, when parked and unattended, so as to prevent unauthorized use. Do not leave such vehicles or equipment unattended with the motor running, or the ignition key in place.
      e. The Owner, and their representatives, the Architect and their Consultants, as well as authorities having jurisdiction will require site accessibility for inspections, observations, and perhaps other purposes, related to the planned new construction.

The Contractor shall assist in such accessibility, to at least the point of providing and maintaining reasonably accessible dry paths to work in progress.

f. Construction operations shall not effect in any manner, the on-going operations of the Owner, immediately adjacent facilities, adjacent property owners or businesses, or others. Refer to Division 1 Section "Special Conditions" for additional information and requirements regarding coordination with Owner's activities.
   1) Construction equipment shall not come in contact with or swing over existing facilities to remain, public areas, occupied buildings, right-of-ways, etc., which are to remain.

g. The Contractor and their employees shall limit any discussion of the Work of this project to the Owner's representatives named in the front of this Project Manual, Consultants employed, inspecting authorities with jurisdiction, and the Architect. In no instance shall this project be discussed with others, except as may otherwise be indicated herein.

h. Parking on-site, if any, shall be limited to the "staging areas" indicated on the Drawings, or if not indicated, as mutually agreed between the Owner, Architect, and Contractor at the Pre-Construction Conference.

i. Smoking or other use of tobacco products shall not be permitted within the Owner's facilities or on roofs.

j. The use or presence of alcohol and/or other debilitating substances shall not be permitted on the project site.

k. Firearms and/or other weapons shall not be permitted on the project site.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 2100
ALLOWANCES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to the work of this Section.

B. Coordinate allowance work with related work to ensure that it is completely integrated and interfaced with related work.

1.02 DESCRIPTION OF REQUIREMENTS:

A. Definitions and Explanations: Certain requirements of the work related to each allowance are shown and specified in contract documents. The allowance has been established in lieu of additional requirements for that work, and further requirements thereof (if any) will be issued by change order.

B. Types of allowances scheduled herein for the work included the following:
   1. Unit cost allowances.
   2. Lump sum allowances.

C. Selection and Purchase:
   1. At earliest feasible date after award of Contract, advise Architect/Engineer of scheduled date when final selection and purchase of each product or system described by each allowance must be accomplished in order to avoid delays in performance of the work.
   2. As requested by the Architect/Engineer, obtain and submit proposals for the work of each allowance for use in making final selections; include recommendations for selection which are relevant to the proper performance of the work.
   3. Purchase products and systems as specified, and as selected (in writing) by the Architect/Engineer.
   4. Submit proposals and recommendations, for purchase of products or systems of allowances, in form specified for change orders.

D. Change Order Data: Include in each change order proposal both the quantities of products being purchased and unit costs, along with total amount of purchases to be made. Where requested, furnish survey-of-requirements data to substantiate quantities. Indicate applicable delivery charges, amounts of applicable trade discounts, and other relevant details as requested by the Architect.
   1. Each change order amount for allowances shall be based on the unit price difference between the actual purchase amount and the allowance, multiplied by the final measure or count of work-in-place, with reasonable allowances, where applicable, for cutting losses, tolerances, mixing wastes, normal product imperfections and similar margins.
   2. Include overhead and profit in the Contractor's Allowance.
   3. When requested, prepare explanations and documentation to substantiate the quantities, costs, and margins as claimed.

E. Change Order Mark-Up:
   1. Except as otherwise indicated, comply with provisions of General Conditions. For each allowance, Contractor's claims for increased costs (for either purchase amount or Contractor's handling, labor, installation, overhead, and profit), because of a change in scope or nature of the allowance work as described in contract documents, must be submitted within 60 days of initial change order authorizing work to proceed on that allowance; otherwise, such claims will be rejected.
   2. Where it is not economically feasible to return unused material to the manufacturer/supplier for credit, prepare unused material for the Owner's storage, and deliver to the Owner's storage space as directed. Otherwise, disposal of excess material is the Contractor's responsibility.

F. Time and Allowance Amounts:

1. Nothing in the Bid or Contract Documents shall be so constructed or interpreted as to provide a Contract time extension, due to use or non-use of any Allowance amount.
2. Nothing in the Bid or Contract Documents shall be so constructed or interpreted as to allow unused Allowances or any portion thereof, nor any overhead and profit therefor to be retained by or paid to the Contractor.
3. Full amount of unused allowances shall be returned to the Owner.

PART 2 PRODUCTS - NOT USED PART 3 EXECUTION - NOT USED

2.01 SCHEDULE OF ALLOWANCES:

A. Allowance No. 1 – INTERIOR DOOR SIGNAGE AND EVACUATION MAP SIGNAGE:
   1. Allow a unit price of $100.00 each for Room Signs for each door, and each of (10) Evacuation Map signs, including purchase, delivery to jobsite, and all related costs, in accordance with Section 10 1400 – “Signage” Selections and Copy will be furnished by Architect after bidding.
   2. Installation and installation material costs shall be included in Allowance, and not as a part of Base Bid.
   3. Overhead and Profit shall be included in Base Bid, and not part of Allowance.
   4. Building Plaques are to be included in Base Bid, and not as part of Allowance.

B. Allowance No. 2 – INTERIOR SIGNAGE ON GLASS:
   1. Allow a Lump Sum price of $2,000.00 for Vinyl Signage with Logo on glass. Specific verbiage and type of lettering will be selected by Architect after bidding.
   2. Installation and installation material costs shall be included in Allowance, and not as a part of Base Bid.
   3. Overhead and Profit shall be included in Base Bid, and not part of Allowance.

C. Allowance No. 3 – EXTERIOR BUILDING AND MONUMENT SIGNAGE:
   1. Allow a Lump Sum price of $8,000.00 for the purchase of Mounted Cast Architectural Letters for the Monument sign and miscellaneous exterior signs, including purchase, delivery to jobsite, and all related costs, in accordance with Section 10 1400 – “Signage” Selections and Copy will be furnished by Architect after bidding.
   2. Installation and installation material costs shall be included in Allowance, and not as a part of Base Bid.
   3. Overhead and Profit shall be included in Base Bid, and not part of Allowance.

D. Allowance No. 4 – TELEVISIONS:
   1. Allow a unit price of $5,000.00 each for each flat screen television and DVD player, including purchase, delivery to jobsite, and all related costs. Specific selections will be furnished by Architect after bidding.
   2. Installation and installation material costs shall be included in Allowance, and not as a part of Base Bid.
   3. Overhead and Profit shall be included in Base Bid, and not part of Allowance.

E. Allowance No. 5 - BRICK MASONRY:
   1. Field Brick: Allow a unit cost of $800.00 per thousand for brick units, including purchase, delivery to the job site, and all related costs. Colors to be selected by Architect.
   2. Include overhead and profit in Base Bid, and not as part of Allowance.
   3. Installation of brick masonry and mortar installation and installation materials (grout, ties, reinforcing, etc.) shall be included in Base Bid, and not as part of Allowance.
   4. Concrete masonry units (CMU), mortar, installation, and installation materials (grout, ties, reinforcing, etc.) shall be in Base Bid, and not as part of Allowance.
   5. The brick will be modular (7-5/8" x 2-1/4" x 3-5/8" depth), unless otherwise indicated, selected by Architect after bidding, with special shapes as indicated and specified.

F. Allowance No. 6 - MASONRY MORTAR:
   1. Allow a unit cost of $22.00 per bag, for the purchase of up to one (1) color of colored mortar, delivered to the job site, including all related expenses.

2. Include overhead and profit in Base Bid, and not as part of Allowance.
3. Masonry, standard gray mortar at interior (painted and unpainted walls - see Finish Schedule), concealed masonry work, and all mortar installation and installation materials (grout, ties, reinforcing, etc.) shall be included in Base Bid, and not as part of Allowance.
4. Mortar color will be selected by the Architect, after award of the Contract for construction of this project.

G. Allowance No. 7 - UNDERCUT AND BACKFILL IN BUILDING CONTROL AREA
1. In accordance with Section 01 2200 - Unit Prices and Section 31 2000 - Earth Moving, include an Allowance for the quantity identified. The Allowance value will be adjusted up or down based on the actual quantity of the Work.
2. See Section 01 2200 - Unit Prices for costs to be included and procedures for payment of Unit Price work.
3. Calculating Allowance:
   a. Unit Price Item A: Undercut and Backfill in Building Control Area
   b. Quantity of TWO THOUSAND (2,000) Cubic Yards (CY)
   c. Unit Price for each CY $_____
   d. Total Allowance Value (b x c): $_____

H. Allowance No. 8 - UNDERCUT AND BACKFILL IN PAVEMENT CONTROL AREA
1. In accordance with Section 01 2200 - Unit Prices and Section 31 2000 - Earth Moving, include an Allowance for the quantity identified. Undercut and Backfill illustrated in the drawings and spcified herein shall be included in the Base Bid, not ass part of Allowance. The Allowance value will be adjusted up or down based on the actual quant
2. See Section 01 2200 - Unit Prices for costs to be included and procedures for payment of Unit Price work.
3. Calculating Allowance:
   a. Unit Price Item B: Undercut and Backfill in Pavement Control Area
   b. Quantity of ONE THOUSAND NINE HUNDRED FIFTY (1,950) Cubic Yards (CY)
   c. Unit Price for each CY $_____
   d. Total Allowance Value (b x c): $_____

I. Allowance No. 9 - GEOTEXTILE FABRIC FOR SUBGRADE STABILIZATION
1. In accordance with Section 01 2200 - Unit Prices, include an allowance for the quantity identified. The Allowance value will be adjusted up or down based on the actual quantity of the work.
2. See Section 01 2200 - Unit Prices for costs to be included and procedures for payment of Unit Price work.
3. Calculating Allowance:
   a. Unit Price Item 17: Geotextile Fabric for Subgrade Stabilization.
   b. Quantity: FIVE THOUSAND EIGHT HUNDRED TWENTY-FIVE Square Yards (5,825 SY).
   c. Unit Price for each SY: $_____
   d. Total Allowance Value (b x c): $_____

J. Allowance No. 10 - DENSE GRADE BASE FOR SUBGRADE STABILIZATION
1. In accorcdance with Section 01 2200 - Unit Prices, include an allowance for the quantity identified. The Allowance value will be adjusted up or down based on the actual quantity of the Work.
2. See Section 01 2200 - Unit Prices for costs to be included and procedures for payment of Unit Price work.
3. Calculating Allowance:
   a. Unit Price Item 18: Dense Grade Base for Subgrade Stabilization
   b. Quantity: TWO THOUSAND THREE HUNDRED FIFTY Tons (2,350 TN)
   c. Unit Price for each TN: $_____
   d. Total Allowance Value (b x c): $_____

K. Allowance No. 11 - CONTINGENCY:
   1. Allow a lump sum price of $100,000.00 as a Contingency Allowance.
   2. Overhead and Profit shall be in Base Bid, and not part of Allowance.

L. Allowance No. 12 - AIDE TO CONSTRUCT
   1. Allow a lump sum price of $100,000 as an Aide to Construct Allowance.
   2. Overhead and Profit shall be in Base Bid, and not part of Allowance.

M. Allowance No. 13 - EMERGENCY RESPONDER RADIO SYSTEM (DAS):
   1. Allow a lump sum of $60,000.00 for purchase of Emergency Responder Radio System.
   2. Include installation of material costs in Allowance.
   3. Include overhead and profit in Allowance and not part of Base Bid.

END OF SECTION

SECTION 01 2200
UNIT PRICES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies administrative and procedural requirements for unit prices.
   1. A unit price is an amount proposed by Bidders and stated on "Attachment A to Proposal Form", as a price per unit of measurement for materials and/or services that will be added to or deducted from the Contract Sum by Change Order in the event the estimated quantities of Work required by the Contract Documents are increased or decreased, in accordance the General Conditions and/or other provisions of the Bid and Contract Documents.
   2. Unit prices shall include all necessary material, labor, fees, layout, supervision (field and home office), general expenses, insurance, bonds, overhead, profit and applicable taxes, for unit item of work in place.
   3. Refer to other Division 1 Sections and individual Specification Sections for construction activities requiring the establishment of unit prices. Methods of approval, verification, measurement and payment for unit prices are specified in those sections.

B. Related work specified elsewhere includes:
   1. Section 01 0150 - Special Conditions.
   2. Division 2 - Existing Conditions Sections.
   3. Division 3 - Concrete Sections.
   4. Division 7 - Thermal and Moisture Protection Sections.
   5. Division 8 - Openings Sections.
   6. Division 9 - Finishes Sections.
   7. Division 10 - Specialties Sections.
   8. Division 11 - Equipment Section.
   9. Divisions 31-35 - Site Work Divisions.

C. Schedule:
   1. A "Unit Price Schedule" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods described under each unit price.
   2. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established unit prices, and to have this work measured by an independent surveyor acceptable to the Contractor at the Owner's expense.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 ITEMIZED UNIT PRICE SCHEDULE

A. Item No. 1 - Sod:
   1. Description: Provide additional sod as directed, including fine grading, soil amendments, fertilizers, sod, maintenance, etc., as specified in Division 32 Sections relating to "Landscape Work".
   2. Unit of Measure: Square yard (SY) of sod, in place.

B. Item No. 2 - Concrete Mud Footings:
   1. Description: Provide additional concrete mud footings, in addition to any mud footings indicated on the Drawings, as specified in Section 03 3100 - “Concrete”, as directed, where required by the Project Geotechnical Consultant due to any existing unsuitable soils.
   2. Unit of Measure: Cubic yard (CY) of concrete mud footings, in place.
   3. Note: This unit price is not applicable to cost of mud footings that are required due to over-excavation, or due to not pouring footings the same date they are excavated, or other reasons indicated in Section 31 2000 - “Earth Moving,” or Section 03 3100 - “Concrete”.

C. Item No. 3 - Undercut & Backfill in Building Control Areas:
   1. Description: Undercutting below planned subgrade in building control areas, and at least 10-feet beyond, as required due to careful inspection by probing, proofrolling, and testing shall be paid on a unit price basis per cubic yard of undercut. Unit price shall include excavation and legal off-site disposal of unsuitable material and replacement with compacted controlled fill back to subgrade elevation in cuts and back to original grade in fills in accordance with Section 31 3200 - "Earth Moving". This shall not apply to previously prepared areas of the site that may become unstable due to construction traffic, rain, etc.
   2. Unit of Measure: Cubic Yard (CY) of unsuitable material.

D. Item No. 4 - Undercut & Backfill in Non-Building Control Areas.
   1. Description: Undercutting below planned subgrade in all areas not included in the building control areas as required due to careful inspection by probing, proofrollling, and testing shall be paid on a unit price basis per cubic yard of undercut. Unit price shall include excavation and legal off-site disposal of unsuitable material and replacement with compacted controlled fill back to subgrade elevation in cuts and back to original grade in fills in accordance with Section 31 2000 - "Earth Moving". This shall not apply to previously prepared areas of the site that may become unstable due to construction traffic, rain, etc.
   2. Unit of Measure: Cubic Yard (CY) of unsuitable material.

E. Item No. 5 - Concrete Sidewalk.
   1. Description: Install concrete sidewalk not otherwise shown on drawings, in location directed by Architect.
   2. Unit of Measure: Square Foot (SF) of sidewalk installed.

F. Item No. 6 - Chain Link Fence:
   1. Description: Install chain link fence not otherwise shown on drawings, as specified in Section 32 3113 - "Chain Link Fences and Gates", in location directed by Architect. This fence is galvanized, with vinyl coating. Height as indicated on drawings.
   2. Unit of Measure: Linear Foot (LF) of fencing, in place.

G. Item No. 7 - Gypsum Board Ceiling.
   1. Description: Provide additional gypsum board ceiling, in accordance with Section 09 2116 - Gypsum Board Assemblies, in location directed by Architect.
   2. Unit of Measure: Square Foot (SF) of Gypsum Board Ceiling, in place.

H. Item No. 8 - Building Canopy.
   1. Description: Provide new canopy as specified in Section 10 7316 - Canopies, where directed by Architect.
   2. Unit of Measure: Square Foot (SF) of canopy, in place.

I. Item No. 9 - WalkwayCanopy.
   1. Description: Provide new canopy as specified in Section 10 7316 - Canopies, where directed by Architect.
   2. Unit of Measure: Square Foot (SF) of canopy, in place.

J. Item No. 10 - Luxury Vinyl Tile (LVT).
   1. Provide additional luxury vinyl tile flooring, in accordance with Section 09 6813, in location directed by Architect.
   2. Unit of Measure: Square Foot (SF) of LVT, in place.

K. Item No. 11 - ACT-1 Ceiling Tile and Grid:
   1. Description: Provide suspended lay-in ceiling and grid, ACT-1, in accordance with Section 09 5100 - Suspended Acoustical Ceilings, in location directed by Architect.
   2. Unit of Measure: Square Foot (SF) of ceiling, in place.

L. Item No. 12 - ACT-2 Ceiling Tile and Grid:

1. Description: Provide suspended lay-in ceiling and grid, ACT-2, in accordance with Section 09 5100 - Suspended Acoustical Ceilings, in location directed by Architect.
2. Unit of Measure: Square Foot (SF) of ceiling, in place.

M. Item No. 13 - Stamped Concrete
1. Description: Install Stamped Concrete not otherwise shown on drawings, in location directed by Architect.
2. Unit of Measure: Square Foot (SF) of Stamped Concrete, in place.

N. Item No. 14 - 57 Stone
1. Description: Provide additional crushed stone, SCDOT #57 or approved equal, as directed by the Owner's Geotechnical Engineer.
2. Unit of Measure: Ton (TN) of crushed stone in place.

O. Item No. 15 - Access Control
1. Description: Provide Access Control, in location directed by Architect.
2. Unit of Measure: Each (EA).

P. Item No. 16 - Panic Device
1. Provide additional Panic Device, as specified in Section 08 7100.
2. Unit of Measure: Each (EA).

Q. Item No. 17 - Geotextile Fabric for Subgrade Stabilization
1. Provide geotextile fabric, as directed.
2. Unit of Measure: Square Yards (SY) of geotextile fabric in place.

R. Item No. 18 - Dense Grade Base for Subgrade Stabilization
1. Provide dense grade base, as directed.
2. Unit of Measure: Tons (TN) or dense grade base in place.

END OF SECTION

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SECTION 01 2900
PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.03 DEFINITIONS

A. Schedule of Values: A statement acceptable to the Owner and Architect furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.04 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
   1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
      a. Application for Payment forms with Continuation Sheets.
      b. Submittals Schedule.
      c. Contractor’s Construction Schedule.
   2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
   1. Identification: Include the following Project identification on the Schedule of Values:
      a. Project name and location.
      b. Contractor's name and address.
      c. Date of submittal.
   2. Submit draft of Schedule of Values that will accompany Application for Payment.
   3. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
      a. Related Specification Section or Division.
      b. Description of the Work.
      c. Name of subcontractor.
      d. Name of manufacturer or fabricator.
      e. Name of supplier.
      f. Change Orders (numbers) that affect value.
      g. Dollar value.
         1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
   4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate. Include separate line items under required principal subcontracts for operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training in the amount of 5 percent of the Contract Sum.
   5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

6. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.
7. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
9. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
10. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.05 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by approving authority and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Forms: Use Application and Certificate for Payment form stipulated in front-end documents as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Approving authority will return incomplete applications without action.
   1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
   2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
   1. Submit partial waivers on each item for amount requested, before deduction for retainage, on each item.
   2. When an application shows completion of an item, submit final or full waivers.
   3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
   4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of subcontractors.
   2. Schedule of Values, including all values for each allowance.
   3. Contractor's Construction Schedule (preliminary if not final).
   4. Products list.
   5. Schedule of unit prices.
   6. Submittals Schedule (preliminary if not final).
   7. List of Contractor's staff assignments.
   8. List of Contractor's principal consultants.
   9. Copies of building permits.
   10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
   11. Initial progress report.
   12. Report of preconstruction conference.
   13. Certificates of insurance and insurance policies.
   14. Performance and payment bonds.
   15. Data needed to acquire Owner's insurance.
   16. Initial settlement survey and damage report if required.

H. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

I. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
   1. Evidence of completion of Project closeout requirements.
   2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
   3. Updated final statement, accounting for final changes to the Contract Sum.
   4. Contractor's Affidavits of Payment of Debts and Claims, Release of Liens, and Consent of Surety to Final Payment.
   5. Evidence that claims have been settled.
   6. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

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SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electronic document submittal service.

B. Requests For Information.

C. Preconstruction meeting.

D. Progress meetings.

E. Submittals for review, information, and project closeout.

F. Number of copies of submittals.

G. Submittal procedures (Including Submittal Numbering/Tracking Guide and form for Transmittal).

H. Inspections.

1.02 RELATED SECTIONS

A. Section 01 0150 - Special Conditions: Additional Administrative and Submittal Requirements.

B. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.

C. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 PROJECT COORDINATION

A. Project Coordinator: Contractor's Project Manager.

B. Cooperate with the Owner and Architect in allocation of mobilization areas of site; for field offices and sheds, for traffic, and parking facilities.

C. During construction, coordinate use of site and facilities through the Owner and Architect.

D. Comply with Owner and Architect's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

E. Comply with instructions of the Owner and Architect for use of temporary utilities and construction facilities.

F. Coordinate field engineering and layout work under instructions of the Owner and Architect.

G. Make the following types of submittals to Architect:
   1. Schedule of Submittals.
   2. Requests for interpretation.
   3. Requests for substitution.
   4. Shop drawings, product data, and samples.
   5. Test and inspection reports.
   6. Design data.
   7. Manufacturer's instructions and field reports.
   8. Applications for payment and change order requests.
   9. Progress schedules.
   10. Coordination drawings.
   11. Correction Punch List and Final Correction Punch List for Substantial Completion.
   12. Closeout submittals.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
   2. Contractor and Architect are required to use this service.
   3. It is Contractor's responsibility to submit documents in allowable format.
   4. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.
   5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
   6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
   7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
      a. Cost: The cost of the service is to be paid by Contractor; include the cost of the service in the Contract Sum.
         1) Submittal Service: The selected service is:
            (a) Submittal Exchange (tel: 1-800-714-0024): www.submittalexchange.com.
         2) Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.
         3) Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.
      b. Substitutions: Any substitutions of submittal service must be approved by the Architect.

3.02 REQUEST FOR INFORMATION

A. All Pre-Bid Questions, or Requests for Information must be submitted through a prequalified General Contractor via email to the Architect's Project Manager, with a copy to Alyssa Martin (alyssa.martin@gmcnetwork.com). Pre-Bid Questions will be accepted up to 48 hours prior to Bid Opening.

B. Send requests for information (RFI's) to Architect's Project Manager and administrative assistant, following the example form included at the end of this section.

C. Sequentially number the Requests for Information (RFI), and date accordingly.

D. Explanations and interpretations will be issued via Addendum.

E. After award of the Bid, a Request for Information (RFI), when submitted to the Architect, may result in an Architect's Supplemental Instruction (ASI), Request for Proposal (RFP), or Construction Change Directive (CCD) prior to the issuance of a Change Order.

3.03 PRECONSTRUCTION CONFERENCES

A. Prior to commencing any work on the project, a pre-construction conference shall be held. Mandatory attendance will be required of the General Contractor and representative of all

specialty and principal subcontractors involved in the project. Time and date of said conference shall be established by the Architect after award of construction contract.

B. Architect will schedule a meeting after Notice of Award.

C. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.

D. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Designation of personnel representing the parties to Contract, and Architect.
   6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Scheduling.
   8. Other items: To be announced.

E. Similarly, prior to commencing any major portion of the Work of the project, preconstruction conferences shall be held. Mandatory attendance will be required of the General Contractor and representative of all specialty and principal subcontractors involved in the individual major portions of project. Time and date of said conferences shall be established by the General Contractor, and the Architect, Owner, and appropriate Consultants shall be advised in writing of times and dates, by the General Contractor.
   1. “Major portion” may be defined as work items for each Subcontractor working on site, and shall include in part, but not be limited to, earthwork, sitework, site utilities, concrete work, masonry, Division 5, roof framing and Division 6, insulation, roofing systems, finishes, specialties, casework, mechanical, plumbing, and electrical.

F. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. The Contractor shall record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made. Emails to Project Team are acceptable.

D. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Contractor's superintendent.
   5. Major subcontractors.

E. Agenda:
   1. Review minutes of previous meetings.
   2. Review of work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.

6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to work.

3.05 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to Architect, using the submittal numbering tracking system, for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.06 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner. No action will be taken.

3.07 SUBMITTALS FOR PROJECT CLOSEOUT

A. When the following are specified in individual sections, submit them at project closeout in conformance to requirements of Section 01 7800 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.
   6. Submit for Owner's benefit during and after project completion.

3.08 NUMBER OF COPIES OF SUBMITTALS (WHEN ELECTRONIC DOCUMENT SUBMITTAL SERVICE IS USED)

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Documents for Project Closeout: Make one reproduction of submittal originally reviewed. Submit one extra of submittals for information.

C. Samples: Submit no less than 3-each of any sample or color chart which is required or otherwise requested, unless more are required in individual specification sections; one of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

D. Refer to Section 01 0150 - "Special Conditions" for additional information and requirements.

3.09 SUBMITTAL PROCEDURES

A. Transmit each submittal with approved form.

B. Transmit each submittal. Sequentially number each transmittal form according to the example shown on the sample Transmittal form provided at the end of this Section. Include the date, project number and name along with number of copies submitted.

C. Deliver submittals to Architect at business address to the attention of the Contract Administration Coordinator.

D. A Submittal Schedule must be submitted and approved by Architect prior to review of any and all submittals.

3.10 SCHEDULING OF INSPECTIONS

A. Contact the design professional by email of the date the project will be ready for an inspection.

B. The design professional will contact the Local Building Inspector to schedule the first available date for the inspection. Inspections must be requested 14 days in advance.

C. After Building Inspector notifies design professional of time of inspection, design professional will notify Contractor, and Owner, copying Building Inspector.

D. Cancellations of any scheduled inspection must be received in writing by email no less than 48 hours prior to the scheduled inspection. The email shall be sent to the Contractor, Building Inspector, and Owner. If an inspection is cancelled, it will be rescheduled subject to Building Inspector's availability.

3.11 MINIMUM REQUIREMENTS FOR REQUIRED INSPECTIONS

A. Use the following minimum requirements to help determine if a project is ready for required inspection:

B. PRE-CONSTRUCTION CONFERENCE.
   1. Required Attendees: Contractor, Owner, Architect, Major Subcontractors.
   2. Inspection Requirements:
      a. Signed construction contract.
      b. Verification of payment of permit fee.
      c. Contractor's Statement of Responsibility and Quality Assurance Plan (for storm shelter).
      d. Fire Alarm Contractor's Certification (from State Fire Marshall).
      e. ADEM permit, if more than 1 acre of land is disturbed.
   3. PRE-ROOFING CONFERENCE.
      a. Required Attendees: Contractor, Owner, Architect, Roofing Subcontractor, Roofing Manufacturer's Representative.
      b. Inspection Requirements:
      c. Roofing submittals must be approved by Architect prior to pre-roofing conference.
      d. Roofing manufacturer must provide documentation that roof design and roofing materials meet code requirements for wind uplift and impact resistance.
      e. Copy of sample roofing warranty.

C. ABOVE-CEILING INSPECTION.
   1. Required Attendees: Contractor, Owner, Architect, MEP Engineers, Major Subcontractors.
   2. Inspection Requirements:
      a. All work must be completed except for installation of ceiling tiles and/or hard ceilings.

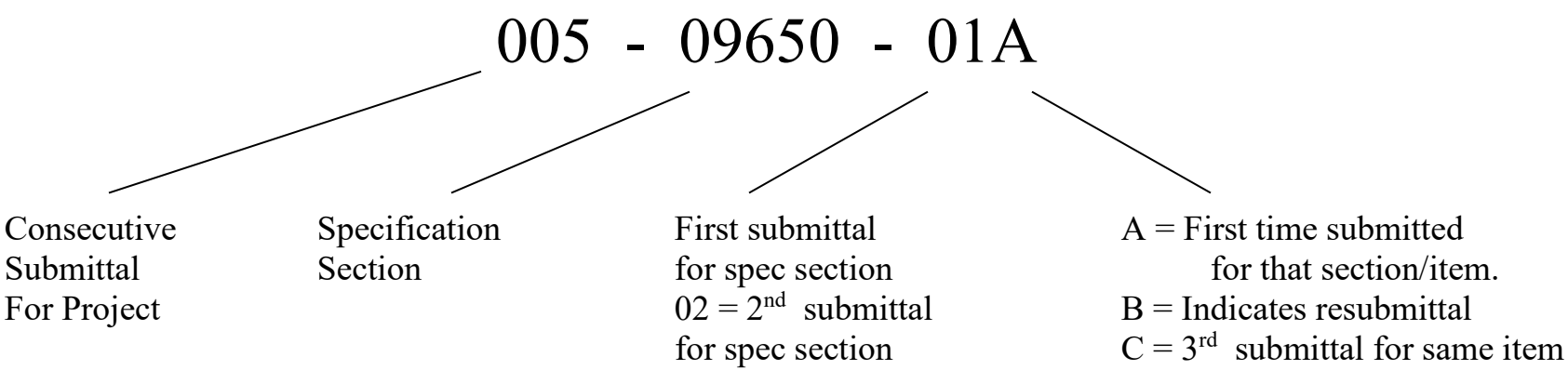
b. Space must be conditioned.
c. Permanent power must be connected unless otherwise arranged with the BC Inspector.
d. Grease duct must be inspected and approved by the BC Inspector prior to fire wrapping and Above-Ceiling Inspection.

D. LIFE SAFETY INSPECTIONS AND FINAL INSPECTIONS.
1. Required Attendees: Contractor, Owner, Architect, Engineers, Major Subcontractors, Local Fire Marshall.
2. Inspection Requirements:
a. Fire alarm certification.
b. Kitchen hood fire suppression system certification.
c. General Contractor's 5-Year Roofing Warranty (ABC Form C-9).
d. Roofing manufacturer's guaranty.
e. Above ground and below ground sprinkler certifications.
f. Completed Certificate of Structural Engineers Observations for storm shelters.
g. Emergency and exit lighting tests.
h. Fire alarm must be monitored.
i. Elevator Inspection completed and Certificate of Operation provided by the State of Alabama Department of Labor.
j. Boiler/Vessels Inspection completed and Certificate of Operation provided by the State of Alabama Department of Labor.
k. Flush test for underground sprinkler lines (witnessed by local fire marshall, fire chief and/or BC Inspector).
l. Flush/pressure test for new and/or existing fire hydrants.
m. Must have clear egress/access and emergency (for first responders) access to building.
n. Must have ADA access completed.

E. YEAR-END INSPECTIONS.
1. Required Attendees: Contractor, Owner, Architect, Engineers and/or Major subcontractors may also be required to attend.
2. Inspection Requirements:
3. Owner's list of documented warranty items.

END OF SECTION

SUBMITTAL NUMBERING / TRACKING



***

INCLUDE ARCHITECT'S PROJECT NUMBER ON ALL SUBMITTAL TRANSMITTALS

**** Architect's Project No. & Name: ABHM250019 HOUSTON COUNTY DEPARTMENT OF HUMAN RESOURCES**
Dothan, Alabama

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REQUEST FOR INFORMATION

RFI No. _____

DATE: _____ PROJECT NAME: _____

GM&C PROJECT No._____

FROM: _____ PROJECT MANAGER: _____

_____ GOODWYN MILLS CAWOOD, LLC.

_____ 2400 Fifth Avenue South, Suite 200

_____ Birmingham, AL 35233

REQUEST:

SIGNATURE: _____

SUGGESTION:

RESPONSE: ROUTING:_____ DATE REC'D: _____

SIGNATURE: _____ DATE RET'D: _____

DISTRIBUTION: O Contract Administrator O Consultant O _____ O _____ O _____

*** SEND THIS FORM TO THE CONTRACT ADMINISTRATION COORDINATOR ***

TRANSMITTAL

No. _____

DATE: _____

FROM: _____

_____

_____

_____

PROJECT: _____

GM&C PROJECT No. _____

PROJECT MANAGER: _____

GOODWYN MILLS CAWOOD, LLC.

2400 Fifth Avenue South, Suite 200

Birmingham, AL 35233

Shop Drawing / Submittal No. (see example below) Description

Copies	Submittal Number	Description

RESPONSE: ROUTING: _____ DATE REC'D: _____

SIGNATURE: _____ DATE RET'D: _____

Shop Drawing / Submittal Number Example 005 - 09650 - 01A

- 005 — Consecutive submittal for Project
- 09650 — Specification Section
- 01 — First submittal for spec section; 02 = 2nd submittal for spec section
- A = First time submitted for that section/item.
  B = Indicates resubmittal
  C = Third submittal for same item

*** SEND THIS FORM TO THE CONTRACT ADMINISTRATION COORDINATOR ***

SECTION 01 3216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, with network analysis diagrams and reports.

1.02 REFERENCE STANDARDS

A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.

B. M-H (CPM) - CPM in Construction Management - Project Management with CPM; 2016, with Addendum (2021).

1.03 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Submit updated schedule with each Application for Payment.

D. Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Architect.

1.04 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.05 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Diagram Sheet Size: Maximum 22 x 17 inches (560 x 432 mm).

C. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a preliminary network diagram.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Provide sub-schedules to define critical portions of the entire schedule.

E. Include conferences and meetings in schedule.

F. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

G. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.

H. Indicate delivery dates for owner-furnished products.

I. Provide legend for symbols and abbreviations used.

J. Show total float for each construction activity.

3.03 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.04 NETWORK ANALYSIS

A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.

B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.

C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
   1. Preceding and following event numbers.
   2. Activity description.
   3. Estimated duration of activity, in maximum 15 day intervals.
   4. Earliest start date.
   5. Earliest finish date.
   6. Actual start date.
   7. Actual finish date.
   8. Latest start date.
   9. Latest finish date.
   10. Total and free float; float time shall accrue to Owner and to Owner's benefit.
   11. Monetary value of activity, keyed to Schedule of Values.
   12. Percentage of activity completed.
   13. Responsibility.

D. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, accepting revised completion dates, and recomputation of all dates and float.

E. Required Reports: List activities in sorts or groups:
   1. By preceding work item or event number from lowest to highest.
   2. By amount of float, then in order of early start.
   3. By responsibility in order of earliest possible start date.
   4. In order of latest allowable start dates.
   5. In order of latest allowable finish dates.
   6. Contractor's periodic payment request sorted by Schedule of Values listings.
   7. Listing of basic input data that generates the report.
   8. Listing of activities on the critical path.

3.05 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.06 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.

3.07 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION

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SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. Testing and inspection agencies and services.

D. Control of installation.

E. Mock-ups.

F. Tolerances.

G. Manufacturers' field services.

H. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures.

B. Section 01 4223 - Reference Standards and Definitions.

C. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.03 DEFINITIONS

A. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

1.04 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2023).

B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2026.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2025.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025b.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2026.

G. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2025.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: For integrated exterior and interior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
   1. Indicate manufacturer and model number of individual components.
   2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions
   3. Fire Protection: Sprinkler shop drawings shall include PE stamp of Professional Engineer licensed in the state in which the project is located.

C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

D. Schedule of Submittals.

E. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

F. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Entity responsible for performing tests and inspections.
   3. Description of test and inspection.
   4. Identification of applicable standards.
   5. Identification of test and inspection methods.
   6. Number of tests and inspections required.
   7. Time schedule or time span for tests and inspections.
   8. Requirements for obtaining samples.
   9. Unique characteristics of each quality-control service.

G. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test/inspection.
      h. Date of test/inspection.
      i. Results of test/inspection.
      j. Compliance with Contract Documents.
      k. When requested by Architect, provide interpretation of results.
   2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

H. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
   1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

I. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

J. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

K. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
   2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications:
   1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
   3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.

1.07 TESTING AND INSPECTION AGENCIES AND SERVICES

A. As indicated in individual specification sections, Owner or Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

C. Contractor Employed Agency:
   1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
   2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
   3. Laboratory: Authorized to operate in the State in which the Project is located.
   4. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
   5. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

D. Refer to Section 01 0150 - "Special Conditions" for additional information and requirements.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

D. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

E. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
   2. Make corrections as necessary until Architect's approval is issued.

F. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

G. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

H. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
   3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
   4. Demonstrate the proposed range of aesthetic effects and workmanship.
   5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
      a. Allow seven days for initial review and each re-review of each mockup.
   6. Build mock-up in the following 3 phases (minimum). Obtain approval of each phase from Architect before proceeding.
      a. Substrate construction, and waterproofing.
      b. Opening installation, and flashing.
      c. Veneer. (Divide this into multiple phases of mock-up if there are multiple layers.)
   7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   8. Protect mock-ups from the elements with weather-resistant membrane.
   9. Demolish and remove mockups when directed unless otherwise indicated.

I. Integrated Exterior Mockups: Construct integrated exterior mockup as indicated on Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

J. Room Mockups: Construct room mockups incorporating required materials and assemblies, finished according to requirements. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work. See Drawings for any required Room Mockups.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

A. See individual specification sections for testing required.

B. Testing Agency Duties:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   6. Perform additional tests and inspections required by Architect.
   7. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect. Payment for re-testing will be charged to the Contractor by deducting testing charges from the Contract Price.

F. Refer to Section 01 0150 - "Special Conditions" for additional information and requirements.

3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of

surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

END OF SECTION

SECTION 01 4100

STRUCTURAL TESTS AND SPECIAL INSPECTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements required for compliance with the International Building Code, Chapter 17, Structural Tests and Special Inspections.

B. Structural testing and special inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve contractor of responsibility for compliance with other construction document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the construction document requirements.
3. Requirements for contractor to provide quality-assurance and -control services required by architect, owner, or authorities having jurisdiction are not limited by provisions of this section.

C. The owner will engage one or more qualified special inspectors and / or testing agencies to conduct structural tests and special inspections specified in this section and related sections and as maybe specified in other divisions of these specifications.

D. Related Sections include but are not limited to the following:

1. Section 0 22000 - “Earthwork”
2. Section 03 3100 - “Cast-In-Place Concrete”
3. Section 05 1200 - “Structural Steel”
4. Section 05 3100 - “Steel Deck”
5. Section 05 4500 – “Light Gauge Steel Trusses”

1.3 DEFINITIONS

A. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by the building official.

B. Construction Documents: Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit. Construction Documents include all supplemental instructions, sketches, addenda, and revisions to the drawings and specifications issued by the registered design professional beyond those issued for a building permit.

C. Shop Drawings / Submittal Data: Written, graphic and pictorial documents prepared and / or assembled by the contractor based on the Construction Documents.

D. Structural Observation: Visual observation of the structural system by a representative of the registered design professional's office for general conformance to the approved construction documents. Structural observations are not considered part of the structural tests and special inspections and do not replace inspections and testing by the testing agency or special inspector.

E. Special Inspector: A qualified person who demonstrating competence, to the satisfaction of the code enforcement official and registered design professional in responsible charge, for inspection of the particular type of construction or operation requiring special inspection. The special inspector shall be a licensed professional engineer or engineering intern or a qualified representative from the testing agency.

F. Special Inspection, Continuous: The full-time observation of work requiring special inspection by an approved special inspector who is present in the area where the work is being performed.

G. Special Inspection, Periodic: The part-time or intermittent observation of work requiring special inspection by an approved special inspector who is present in the area where the work has been or is being performed and at the completion of the work.

H. Testing Agency: A qualified materials testing laboratory under the responsible charge of a licensed professional engineer, approved by the code enforcement official and the registered design professional in responsible charge, to measure, examine, test, calibrate, or otherwise determine the characteristics or performance of construction materials and verify confirmation with construction documents.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Minimum qualifications of inspection and testing agencies and their personnel shall comply with ASTM E329-03 Standard Specification for Agencies in the Testing and / or Inspection of Materials Used in Construction.

    a. Inspectors and individuals performing tests shall be certified for the work being performed as outlined in the appendix of the ASTM E329. Certification by organizations other than those listed must be submitted to the building official for consideration before proceeding with work.

2. In addition to these requirements, local jurisdiction may have additional requirements. It is the responsibility of the testing and inspection agencies to meet local requirements and comply with local procedures.

B. Qualifications of Special Inspector: The Special Inspector shall be a qualified person who shall demonstrate competence, to the satisfaction of the Building Official, for inspection of the particular type of construction or operation being inspected. The Special Inspector shall meet the legal qualifications of the building code having jurisdiction.

1. Duties and Responsibilities of the Special Inspector:

a. The Special Inspector shall observe the work assigned to ascertain, to the best of his/her knowledge that it is in conformance with the approved design drawings and specifications.

b. The Special Inspector shall furnish inspection reports to the Building Official, the Architect/Engineer, and the Owner. All discrepancies shall be brought to the immediate attention of the Architect/Engineer, Contractor, and Owner. A report that the corrected work has been inspected shall be sent to the Building Official, the Architect/Engineer, and the Owner.

c. The Special Inspector shall create and maintain a log of all discrepancies throughout the duration of the project. This log shall include, but is not limited to, discrepancy date, description, drawing and/or detail reference, description of as-built condition, description of any remedial work performed, and status of discrepancy. This log shall be submitted to the Architect/Engineer on a periodic basis for the review and comment. Upon completion of the project, this log shall be submitted in its entirety as an attachment to the final signed report described below.

d. The Special Inspector shall submit a final signed report stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance to the approved plans and specifications and the applicable workmanship provisions of the building code.

1.5 CONFLICTING REQUIREMENTS, REPORTS, AND TEST RESULTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the registered design professional in responsible charge for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to the registered design profession in responsible charge for a decision before proceeding.

C. The special inspector's reports and testing agencies results shall have precedence over reports and test results provided by the contractor.

D. Where a conflict exists between the construction documents and approved shop drawings / submittal data, the construction documents shall govern unless the shop drawings / submittal data are more restrictive. All conflicts shall be brought to the attention of the registered design professional in responsible charge.

1.6 SUBMITTALS BY SPECIAL INSPECTOR AND / OR TESTING AGENCY

A. Special inspectors shall keep and distribute records of inspections. The special inspector shall furnish inspection reports to the building official, and to the registered design professional in responsible charge, contractor, architect, and owner. Reports shall indicate that work inspected was done in conformance to approved construction documents. Discrepancies shall be brought to the immediate attention of the contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the building official and to the registered design professional in

responsible charge prior to the completion of that phase of the work. A final report documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted at a point in time agreed upon by the permit applicant and the building official prior to the start of work.

1. Special inspection reports and test results shall include, but not be limited to, the following:

    a. Date of inspection.
    b. Description of inspections or tests performed including location (reference grid lines, floors, elevations, etc.).
    c. Statement noting that the work, material, and / or product conforms or does not conform to the construction document requirements.

        1) Name and signature of contractor's representative who was notified of work, material, and / or products that do not meet the construction document requirements.

    d. Name and signature of special inspector and / or testing agency representative performing the work.

B. Schedule of Non-Compliant Work: Each agent shall maintain a log of work that does not meet the requirements of the construction documents. Include reference to original inspection / test report and subsequent dates of re-inspection / retesting.

C. Reports and tests shall be submitted within 1 week of inspection or test. Schedule of Non-Compliant Work shall be updated daily and submitted at monthly intervals.

D. Final Report of Special Inspections. Submitted by each agent listed in the schedule of Structural Testing and Special Inspections.

1.7 PAYMENT OF TESTING LABORATORY

A. The Owner will pay for the initial laboratory services for the testing of materials for compliance with the requirements of the contract documents. The Contractor will be liable to the Owner for the cost for testing and retesting of materials that do not comply with the requirements of the contract documents and shall furnish and pay for the testing and inspection of other items as specified in these Specifications.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.1 CONTRACTOR'S RESPONSIBILITY

A. The contractor shall coordinate the inspection and testing services with the progress of the work. The contractor shall provide sufficient notice to allow proper scheduling of all personnel. The contractor shall provide safe access for performing inspection and on site testing.

B. The contractor shall submit schedules to the owner, registered design professionals and testing and inspecting agencies. Schedules will note milestones and durations of time for materials requiring structural tests and special inspections.

C. The contractor shall repair and / or replace work that does not meet the requirements of the construction documents.

1. Contractor shall engage an engineer / architect to prepare repair and / or replacement procedures.
2. Engineer / architect shall be registered in the state in which the project is located. Engineer shall be acceptable to the registered design professional in responsible charge, code enforcement official, and owner.
3. Procedures shall be submitted for review and acceptance by the registered design professional in responsible charge, code enforcement official, and owner before proceeding with corrective action.

D. The contractor shall be responsible for costs of:

1. Re-testing and re-inspection of materials, work, and / or products that do not meet the requirements of the construction documents and shop drawings / submittal data.
2. Review of proposed repair and / or replacement procedures by the registered design professional in responsible charge and the inspectors and testing agencies.
3. Repair or replacement of work that does not meet the requirements of the construction documents.

3.2 STRUCTURAL OBSERVATIONS

A. Structural observations may be made periodically as determined by the registered design professional in responsible charge.

3.3 TESTING AND INSPECTION

A. Testing and inspection shall be in accordance with the attached Schedule of Special Inspections.

B. Reference related specifications for the minimum level of inspections and testing. Provide additional inspections and testing as necessary to determine compliance with the construction drawings.

3.4 SCHEDULES AND FORMS – ATTACHED OR IN CONSTRUCTION DOCUMENTS

A. STATEMENT OF SPECIAL INSPECTIONS

B. SCHEDULE OF SPECIAL INSPECTIONS (ON STRUCTURAL DRAWINGS)

C. FINAL REPORT OF SPECIAL INSPECTIONS

END OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

STATEMENT OF SPECIAL INSPECTIONS

Project:
Project Address:
Permit Applicant:
Applicant Address:
Owner:
Owner Address:

Registered Design Professionals (RDP):

Architect:
Geotechnical Engineer:
Structural Engineer:
Mechanical Engineer:
Electrical Engineer:

This statement of special inspections is submitted as a condition for permit issuance in accordance with Chapter 17 of the International Building Code. It includes a *Schedule of Special Inspections* applicable to the above referenced project as well as the identity of the individuals, agencies, or firms intended to be retained for conducting these inspections.

The Special Inspector(s) shall keep records of all inspections and shall furnish interim inspection reports to the building official and to the registered design professional in responsible charge at a frequency agreed upon by the permit applicant and building official prior to the start of work. Discrepancies shall be brought to the immediate attention of the contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the building official and the registered design professional in responsible charge prior to completion of that phase of work. A *Final Report of Special Inspections* documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted by each agent at the completion of that phase of work.

Maximum frequency of interim report submittals shall not be less than_____.

The Special Inspection program does not relieve the contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Owner's Acknowledgement:

_____
Signature Date

Building Official's Acceptance:

_____
Signature Date

_____
Permit No.

FINAL REPORT OF SPECIAL INSPECTIONS

Project:
Project Address:
Testing / Inspection Agent:
Testing / Inspection Agent Address:
Scope of Testing / Inspections:

(To be completed by Testing / Inspection Agent)

To the best of my information, knowledge, and belief, the special inspections or testing required for this project, and designated for this Agent in the *Schedule of Special Inspections* submitted for permit, have been completed in accordance with the contract documents.

Interim reports submitted prior to this final report and numbered _____ to _____ form a basis for, and are to be considered an integral part of this final report. The following discrepancies that were outstanding since the last interim report dated have been corrected:

_____

_____

(Attach 8 1/2" x 11" continuation sheet(s) if required to complete the description of corrections)

Prepared By:

_____
Type or print name

_____
Signature Date

Special Inspector's Seal

(Licensed Professional Engineer)

SECTION 01 4216
DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

A. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

A. Furnish: To supply, deliver, unload, and inspect for damage.

B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

D. Provide: To furnish and install.

E. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 4219
REFERENCE STANDARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements relating to referenced standards.

B. Reference standards full title and edition date.

1.02 QUALITY ASSURANCE

A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.

C. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Architect shall be altered by Contract Documents by mention or inference otherwise in any reference document.

PART 2 CONSTRUCTION INDUSTRY ORGANIZATION DOCUMENTS

2.01 AA -- ALUMINUM ASSOCIATION, INC.

2.02 AAMA -- AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION

A. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2025.

B. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2024.

C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

D. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2026.

2.03 ACI -- AMERICAN CONCRETE INSTITUTE INTERNATIONAL

A. ACI 301 - Specifications for Concrete Construction; 2020.

B. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.

C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).

D. ACI 305R - Guide to Hot Weather Concreting; 2020.

E. ACI 306R - Guide to Cold Weather Concreting; 2016.

F. ACI 318 - Building Code Requirements for Structural Concrete; 2019 (Reapproved 2022).

G. ACI 347R - Guide to Formwork for Concrete; 2014 (Reapproved 2021).

2.04 ADC -- AIR DIFFUSION COUNCIL

A. ADC 1062: GRD - Test Code for Grilles, Registers & Diffusers; 1984.

2.05 AHRI -- AIR-CONDITIONING, HEATING, AND REFRIGERATION INSTITUTE

A. AHRI 430 (I-P) - Standard for Performance Rating of Central Station Air-handling Unit Supply Fans; 2020.

2.06 AISC -- AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC.

2.07 AISI -- AMERICAN IRON AND STEEL INSTITUTE

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data; 2017.

C. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.

D. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2020.

2.08 AMCA -- AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.

B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.

C. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2021, with Editorial Revision (2022).

2.09 ANSI -- AMERICAN NATIONAL STANDARDS INSTITUTE

A. ANSI 117 - Standard Specification for Structural Glued Laminated Timber of Softwood Species; 2025.

B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.

C. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2020.

D. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs; 2020.

E. ANSI A250.4 - American National Standard Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings.; 2011.

F. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames.; 2003.

G. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.; 1998 (R2011).

H. ANSI/AHIA Z60.1 - American National Standard for Nursery Stock; 2014.

2.10 ARI -- AIR-CONDITIONING AND REFRIGERATION INSTITUTE (SEE AHRI)

2.11 ASCE -- AMERICAN SOCIETY OF CIVIL ENGINEERS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

2.12 ASHRAE -- AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.

A. ASHRAE Std 20 - Methods of Laboratory Testing Remote Mechanical-Draft Air-Cooled Refrigerant Condensers; 2019.

B. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ASHRAE Std 90.1 I-P-2013 - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013.

2.13 ASME -- THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

C. ASME B31.9 - Building Services Piping; 2025.

2.14 ASTM A SERIES -- ASTM INTERNATIONAL

A. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2026.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

G. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.

H. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength; 2014a.

I. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

J. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2026.

K. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019 (Reapproved 2025).

L. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

M. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

N. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2024.

O. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2022.

P. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2025.

Q. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2026.

R. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

S. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.

2.15 ASTM B SERIES -- ASTM INTERNATIONAL

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

B. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2023.

C. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2022.

D. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products; 2025.

2.16 ASTM C SERIES -- ASTM INTERNATIONAL

A. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.

B. ASTM C90 - Standard Specification for Dry-Cast Loadbearing Concrete Masonry Units; 2024a.

C. ASTM C91/C91M - Standard Specification for Masonry Cement; 2025.

D. ASTM C129 - Standard Specification for Dry-Cast Nonloadbearing Concrete Masonry Units; 2025.

E. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2026.

F. ASTM C143/C143M - Standard Test Method for Slump of Concrete; 2026a.

G. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2025.

H. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.

I. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2024.

J. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2024.

K. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2025b.

L. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2024.

M. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).

N. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

O. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2024.

P. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2026).

Q. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

R. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

S. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019 (Reapproved 2025).

T. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

U. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

V. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2025a.

W. ASTM C836/C836M - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course; 2018 (Reapproved 2022).

X. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2025.

Y. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).

Z. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

AA. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

BB. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2024.

CC. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

DD. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).

EE. ASTM C1036 - Standard Specification for Flat Glass; 2025.

FF. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

GG. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.

HH. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength; 2022.

II. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2024, with Editorial Revision (2025).

JJ. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.

KK. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2024.

LL. ASTM C1186 - Standard Specification for Flat Fiber-Cement Sheets; 2022, with Editorial Revision (2023).

MM. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.

NN. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2025.

OO. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2024.

PP. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2025.

QQ. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.

RR. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.

2.17 ASTM D SERIES -- ASTM INTERNATIONAL

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.

B. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2025.

C. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.

D. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2024.

E. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2024).

F. ASTM D3161/D3161M - Standard Test Method for Wind Resistance of Steep Slope Roofing Products (Fan-Induced Method); 2020 (Reapproved 2025).

G. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement; 2025.

H. ASTM D4869/D4869M - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing; 2016a (Reapproved 2025).

2.18 ASTM E SERIES -- ASTM INTERNATIONAL

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

B. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

C. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2026.

D. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2026.

E. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

F. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

G. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

H. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2020.

I. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2024a.

J. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

K. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).

L. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2024.

M. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2024.

N. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

O. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.

P. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-Story Test Apparatus; 2025b.

2.19 ASTM F SERIES -- ASTM INTERNATIONAL

A. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact; 2017 (Reapproved 2023).

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2025.

D. ASTM F1292 - Standard Specification for Impact Attenuation of Surfacing Materials Within the Use Zone of Playground Equipment; 2022.

E. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples; 2021.

F. ASTM F1700 - Standard Specification for Solid Vinyl Floor in Modular Format such as Tile(s) or Plank(s); 2025.

G. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021 (Reapproved 2025).

2.20 AWI/AWMAC/WI -- JOINT PUBLICATION OF ARCHITECTURAL WOODWORK INSTITUTE/ARCHITECTURAL WOODWORK MANUFACTURERS ASSOCIATION OF CANADA/WOODWORK INSTITUTE

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

2.21 AWMAC/WI -- JOINT PUBLICATION OF ARCHITECTURAL WOODWORK MANUFACTURERS ASSOCIATION OF CANADA/WOODWORK INSTITUTE

A. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

2.22 AWPA -- AMERICAN WOOD-PRESERVERS' ASSOCIATION

A. AWPA U1 - Use Category System: User Specification for Treated Wood; 2025.

2.23 AWS -- AMERICAN WELDING SOCIETY

A. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

B. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

C. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).

D. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2025, with Errata (2026).

2.24 AWWA -- AMERICAN WATER WORKS ASSOCIATION

A. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2023.

2.25 BHMA -- BUILDERS HARDWARE MANUFACTURERS ASSOCIATION

A. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.

2.26 BIA -- BRICK INDUSTRY ASSOCIATION

A. BIA Technical Notes No. 28B - Brick Veneer/Cold-Formed Steel Framed Walls; 2025.

A. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.

B. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.

C. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.

2.27 CDA -- COPPER DEVELOPMENT ASSOCIATION, INC.

A. CDA A4050 - Copper in Architecture - Handbook; Current Edition.

2.28 DHI -- DOOR AND HARDWARE INSTITUTE

2.29 FM -- FACTORY MUTUAL GLOBAL

A. FM (AG) - FM Approval Guide; Current Edition.

2.30 GA -- GYPSUM ASSOCIATION

A. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

B. GA-600 - Fire Resistance and Sound Control Design Manual; 2024.

2.31 GANA -- GLASS ASSOCIATION OF NORTH AMERICA

A. GANA (GM) - GANA Glazing Manual; 2022.

B. GANA (SM) - GANA Sealant Manual; 2008.

2.32 HPVA -- HARDWOOD PLYWOOD VENEER ASSOCIATION

A. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2024.

2.33 ICC -- INTERNATIONAL CODE COUNCIL, INC.

A. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. ICC (IFC) - International Fire Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

A. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

2.34 ITS -- INTERTEK TESTING SERVICES NA, INC.

A. ITS (DIR) - Directory of Listed Products; Current Edition.

2.35 MPI -- MASTER PAINTERS INSTITUTE (MASTER PAINTERS AND DECORATORS ASSOCIATION)

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

2.36 NAAMM -- THE NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS

A. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

B. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2024.

C. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

2.37 NEMA -- NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

A. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

B. NEMA MG 1 - Motors and Generators; 2021.

2.38 NFPA -- NATIONAL FIRE PROTECTION ASSOCIATION

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2026.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; 2024.

D. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection; 2025.

E. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances; 2025.

F. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems; 2026, with Amendment (2025).

G. NFPA 30 - Flammable and Combustible Liquids Code; 2024, with Errata (2025).

H. NFPA 54 - National Fuel Gas Code; 2024.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

K. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025, with Amendment (2024).

L. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

M. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

N. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

P. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

Q. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; 2006.

R. NFPA 2001 - Standard on Clean Agent Fire Extinguishing Systems; 2025.

2.39 NRCA -- NATIONAL ROOFING CONTRACTORS ASSOCIATION

A. NRCA (RM) - The NRCA Roofing Manual; 2026.

2.40 RIS -- REDWOOD INSPECTION SERVICE

A. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber; 2019.

2.41 SDI -- STEEL DOOR INSTITUTE

A. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.

2.42 SMACNA -- SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC.

A. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

2.43 SPIB -- SOUTHERN PINE INSPECTION BUREAU, INC.

A. SPIB (GR) - Standard Grading Rules; 2021.

2.44 SSPC -- SOCIETY FOR PROTECTIVE COATINGS

A. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

B. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

C. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

D. SSPC-SP 2 - Hand Tool Cleaning; 2024.

E. SSPC-SP 11 - Power-Tool Cleaning to Bare Metal; 2020.

2.45 TCNA -- TILE COUNCIL OF NORTH AMERICA, INC.

A. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2025-2026.

A. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.

2.46 TMS -- THE MASONRY SOCIETY

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

2.47 UL -- UNDERWRITERS LABORATORIES INC.

A. UL (DIR) - Online Certifications Directory; Current Edition.

B. UL (EAUED) - Electrical Appliance and Utilization Equipment Directory; current edition.

C. UL (FRD) - Fire Resistance Directory; Current Edition.

D. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

E. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

F. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems; Current Edition, Including All Revisions.

G. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

I. UL 864 - Control Units and Accessories for Fire Alarm Systems; Current Edition, Including All Revisions.

J. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

K. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

2.48 WCLIB -- WEST COAST LUMBER INSPECTION BUREAU

A. WCLIB (GR) - WCLB Standard Grading Rules for West Coast & Imported Softwood Lumber No.18; 2024.

2.49 WWPA -- WESTERN WOOD PRODUCTS ASSOCIATION

A. WWPA G-5 - Western Lumber Grading Rules; 2025.

PART 3 UNITED STATES GOVERNMENT AND RELATED AGENCIES DOCUMENTS

3.01 CFR -- CODE OF FEDERAL REGULATIONS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

C. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

D. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

3.02 PS -- PRODUCT STANDARDS

A. PS 20 - American Softwood Lumber Standard; 2025.

END OF SECTION

SECTION 01 4533
CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Code-required special inspections.

B. Testing services incidental to special inspections.

C. Submittals.

1.02 DEFINITIONS

A. Code or Building Code: ICC (IBC), International Building Code, most recent edition adopted by authority having jurisdiction, including all applicable amendments and supplements without limitation, and specifically Chapter 17 - Special Inspections and Tests.

B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.

C. Special Inspections and Tests: Inspections and testing of materials, installation, fabrication, erection, or placement of components and connections mandated by Building Code to safeguard public welfare.
   1. Special inspections and tests are separate from and independent of tests and inspections conducted by Owner or Contractor for purposes of quality assurance and contract administration.

1.03 REFERENCE STANDARDS

A. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025b.

B. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2025.

C. IAS AC291 - Accreditation Criteria for Special Inspection Agencies AC291; 2025, with Editorial Revision.

D. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Fabricator's Qualification Statement: When required by AHJ, submit documentation of fabrication facilities and methods and quality control procedures. Include documentation of AHJ approval.

C. Special Inspection Reports: After each special inspection, Special Inspector is required to submit at least two copies of report; one to Architect and one to AHJ.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of Special Inspector.
      d. Date and time of special inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of special inspection.
      h. Date of special inspection.
      i. Results of special inspection.
      j. Compliance with contract documents.
   2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.

D. Test Reports: After each test or inspection, Testing Agency is required to submit report to Architect and to AHJ.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test or inspection.
      h. Date of test or inspection.
      i. Results of test or inspection.
      j. Compliance with contract documents.

1.05 SPECIAL INSPECTION AND TESTING AGENCY

A. Owner or Architect to employ services of Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by building code.

B. Special Inspection Agency may delegate to independent testing agency to perform testing and sampling associated with special inspections and required by building code.

C. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of contract documents.

1.06 TESTING AND INSPECTION AGENCIES

A. Owner or Architect may employ services of independent testing agency to perform additional testing and sampling required by contract documents or associated with special inspections but not required by building code.

B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of contract documents.

1.07 QUALITY ASSURANCE

A. Special Inspection Agency Qualifications:
   1. Independent firm specializing in performing testing and inspections of the type specified in this section.
   2. Accredited by IAS according to IAS AC291.

B. Testing Agency Qualifications:
   1. Independent firm specializing in performing testing and inspections of the type specified in this section.
   2. Accredited by IAS according to IAS AC89.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

A. The Code requires special inspections and testing of certain materials, components, assemblies, and connections used in constructing the project. Special inspections and testing will be performed in accordance with the Code.

B. Special inspections and testing will be performed in accordance with the Code for the following materials and project components:
   1. Concrete.
   2. Masonry.
   3. Wood.
   4. Soils.
   5. Driven deep foundations.
   6. Cast-in-place deep foundations.
   7. Helical pile foundations.

8. Vertical masonry foundation elements.
9. Sprayed fire-resistant materials.
10. Mastic and intumescent fire-resistant coatings.
11. Exterior insulation and finish systems (EIFS).
12. Fire-resistant penetrations and joints.
13. Smoke control testing.
14. Seismic resistance.
15. Wind resistance.

3.02 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

A. Special Inspection Agency shall:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified reference standards.
   3. Ascertain compliance of materials and products with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests or inspections specified.

B. Limits on Special Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the work.

C. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

D. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.03 TESTING AGENCY DUTIES AND RESPONSIBILITIES

A. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests or inspections specified.

B. Limits on Testing or Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the work.

C. On instructions by Architect, perform re-testing required because of non-compliance with specified requirements, using the same agency.

D. Contractor will pay for re-testing required because of non-compliance with specified requirements.

3.04 CONTRACTOR DUTIES AND RESPONSIBILITIES

A. Contractor Responsibilities, General:
   1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
   2. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to work to be tested or inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
      c. To facilitate tests or inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
   5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

B. Contractor Responsibilities, Seismic Force-Resisting System, Designated Seismic System, and Seismic Force-Resisting Component: Submit written statement of responsibility for each item listed in the Statement of Special Inspections to AHJ and Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.

C. Contractor Responsibilities, Wind Force-Resisting System and Wind Force-Resisting Component: Submit written statement of responsibility for each item listed in the Statement of Special Inspections to AHJ and Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.

END OF SECTION

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary telecommunications services.

C. Temporary sanitary facilities.

D. Temporary Controls: Barriers, enclosures, and fencing.

E. Security requirements.

F. Vehicular access and parking.

G. Waste removal facilities and services.

H. Field offices.

1.02 RELATED REQUIREMENTS

A. Section 01 5813 - Temporary Project Signage.

1.03 TEMPORARY UTILITIES

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

B. Existing facilities may not be used.

1.04 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

B. Telecommunications services shall include:
   1. Telephone Lines: One line, minimum; one handset per line.
   2. Internet Connections: Minimum of one; DSL modem or faster.
   3. Cellular phones are an acceptable substitute for items 1 & 2, provided they fulfill requirements of same.

1.05 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

1.06 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING

A. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular and pedestrian gates with locks. Provide gates as required by Contractor and/or authorities having jurisdiction, with all related safety and warning signs.

B. Fencing shall be at least 11-1/2 gauge galvanized chain-link fencing, securely held in place by posts, braces, rails, etc.

C. Fence shall be approximately 30-feet from perimeter of buildings, unless Drawings indicate otherwise. Extent of fencing shall be as required to maintain a secure worksite.

D. All such fencing shall be removed upon completion of the work of this project, removed from the site, and any post holes filled and compacted same as adjacent grade or paving, by the Contractor.

E. Responsibility and maintenance of such fencing and areas within such fencing shall be held by this Contractor beginning at the date of its erection and until its removal, close to the date of project completion.

1.08 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.09 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner's security program.

1.10 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Designated existing on-site roads may be used for construction traffic.

F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.11 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.12 PROJECT SIGNS - SEE SECTION 01 5813

1.13 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 10 persons.

C. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures.

1.14 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet (600 mm).

C. Clean and repair damage caused by installation or use of temporary work.
D. Restore existing facilities used during construction to original condition.
E. Restore new permanent facilities used during construction to specified condition.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

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SECTION 01 5813
TEMPORARY PROJECT SIGNAGE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Project identification sign.

B. Project informational signs.

1.02 RELATED REQUIREMENTS

A. Section 01 0150 - Special Conditions: Supplemental sign information.

B. Project Sign Detail: Included at the end of this Section.

1.03 REFERENCE STANDARDS

A. FHWA (SHS) - Standard Highway Signs; Federal Highway Administration; 2004.

1.04 QUALITY ASSURANCE

A. Design sign and structure to withstand 50 miles/hr (80 km/hr) wind velocity.

B. Sign Painter: Experienced as a professional sign painter for minimum three years.

C. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawing: Show content, layout, lettering, color, foundation, structure, sizesand grades of members.

PART 2 - PRODUCTS

2.01 SIGN MATERIALS

A. Structure and Framing: New, wood, structurally adequate.

B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4 inch (19 mm) thick, standard large sizes to minimize joints.
   1. See Project Sign Detail for Options.
      a. Rough Hardware: Galvanized.
      b. Paint and Primers: Exterior quality, two coats; sign background of color as selected.
      c. Lettering: Exterior quality paint, colors as selected.
         1) See Project Sign Detail for Options.

2.02 PROJECT IDENTIFICATION SIGN

A. Painted sign of construction, design, and content shown on Project Sign Detail, and described below.
   1. Refer to Detail of Project Sign, following this Section.
   2. Content:
      a. Project number, title, logo and name of Owner as indicated on Contract Documents.
      b. Names and titles of authorities.
      c. Names and titles of Architect.
      d. Name of Contractor.
   3. Graphic Design, Colors, Style of Lettering: Designated by Architect.

2.03 PROJECT INFORMATIONAL SIGNS

A. Painted informational signs of same colors and lettering as Project Identification sign, or standard products; size lettering to provide legibility at 100 foot (30 m) distance.

B. Provide at each field office, storage shed, and directional signs to direct traffic into and within site. Relocate as Work progress requires.

C. Provide municipal traffic agency directional traffic signs to and within site.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install project identification sign within 30 days after date fixed by Notice to Proceed.

B. Erect at location of high public visibility adjacent to main entrance to site.

C. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.

D. Install sign surface plumb and level, with butt joints. Anchor securely.

E. Paint exposed surfaces of sign, supports, and framing.

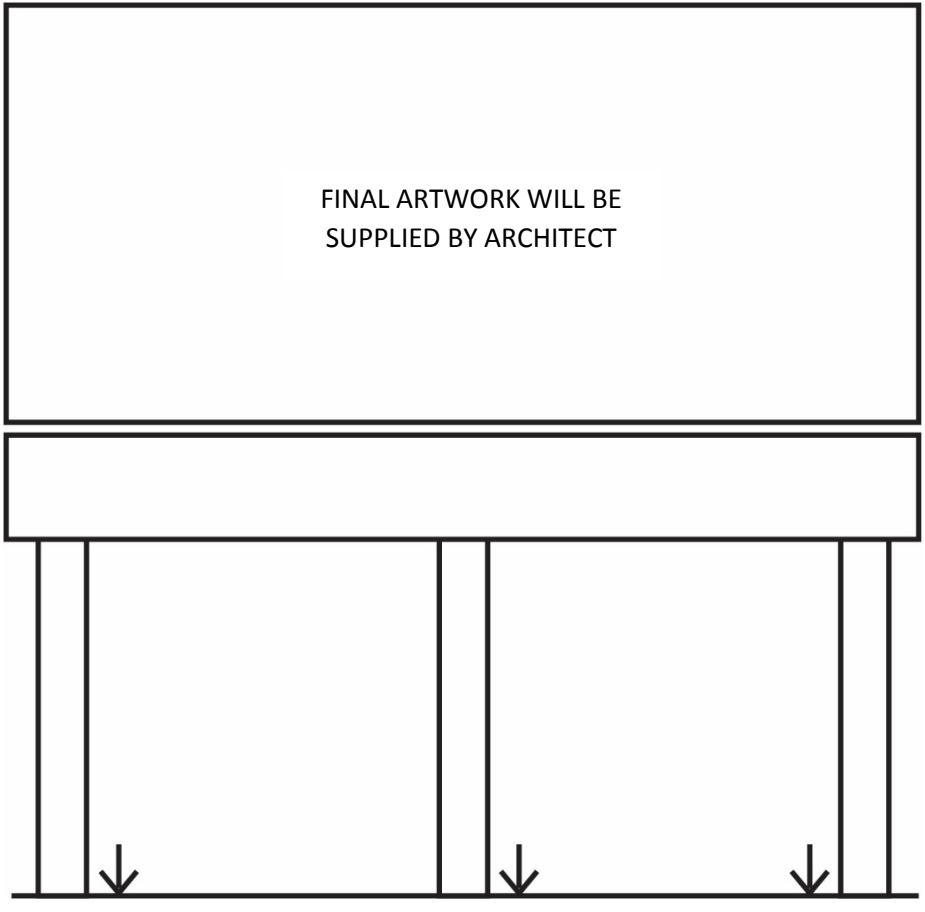
3.02 MAINTENANCE

A. Maintain signs and supports clean, repair deterioration and damage.

3.03 REMOVAL

A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

END OF SECTION



SIGN: 8’ X 4’ SIGN WITH 8’ X 1’ADDITION PRINTED ON ½” THICK COROPLAST OR CORRUGATED ALUMINUM, PRINTED ON FLAT-BED ARIZONA PRINTER OR EQUIVALENT WITH UV INKS IN FULL COLOR. CONTACT ARCHITECT FOR FINAL ARTWORK.

OPTION: PRINT ON EXTERIOR GRADE VINYL WITH UV INKS IN FULL COLOR APPLIED TO 8’ X 4’ X ½” THICK COROPLAST OR CORRUGATED ALUMINUM. CONTACT ARCHITECT FOR FINAL ARTWORK.

WOOD POSTS: P.T. 4 X 4 X FULL HEIGHT OF SIGN, WITH 45˚ TO 60˚ SLOPED P.T. 4 X 4 WOOD BACK BRACES FROM TOP OF SIGN, BRACE BETWEEN POSTS AT TOP & BOTTOM W/FLAT P.T. 2 X 6 OR 4 X 4. SET POSTS 3’- O” MINIMUM INTO GROUND, IN 12” DIAMETER X 3’ - 6” DEEP CONCRETE FOOTINGS.

TOP OF SIGN: 7 FT. TO 8 FT. ABOVE FINISHED GRADE.

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations.

E. Procedures for Owner-supplied products.

F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Instructions To Bidders, and Supplementary Instructions To Bidders: Additional information and requirements concerning Substitutions.

B. Section 01 4000 - Quality Requirements: Product quality monitoring.

1.03 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 - PRODUCTS

2.01 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. DO NOT USE products having any of the following characteristics:
   1. Made of wood from newly cut old growth timber.

C. Where all other criteria are met, Contractor shall give preference to products that:
   1. Are extracted, harvested, and/or manufactured closer to the location of the project.
   2. Have longer documented life span under normal use.
   3. Result in less construction waste.
   4. Are made of vegetable materials that are rapidly renewable.

2.02 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.03 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 - EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. Acceptance of suppliers, manufacturers, and/or products shall be limited to those named, unless others are properly submitted during bidding in accordance with substitution procedures, and subsequently accepted.

B. Instructions to Bidders specifies time restrictions and procedures for submitting requests for substitutions during the bidding period. These time restrictions and procedures are superceded by any modifications found in Supplementary Instructions to Bidders (or Additions to Instructions to Bidders).

C. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
   1. Submittals during construction other than those pre-qualified or pre-accepted will not be reviewed, but instead returned for re-submittal, without exception.

D. Substitution Submittal Procedure. A proper pre-bid submittal for "pre-qualified" or "pre-accepted" consideration and review, shall be one which includes at least the following:
   1. Submit request for substitution for consideration. Limit each request to one proposed substitution.
   2. Use Substitution Request form attached at end of this Section.
   3. Submit with cover letter which outlines the purpose of the submittal, Architect's specifications which apply, and each variation from the original specification.
   4. Submit product data (all current and relevant manufacturer's published data), certified test results attesting to the proposed product equivalence, and additional information as required so that a review can be quickly made by comparing the submittal item for item to the original specification. Include samples and other data as requested for the original item. Burden of proof is on proposer.
   5. Substitution requests shall be submitted through a qualified General Contractor bidding the project.

E. After receipt of bids and execution of the Construction Contract, the Owner and the Architect will consider substitutions only under the following conditions:
   1. Unavailability of materials if beyond the control of the Contractor and submitted proof that firm orders for the material were placed within ten (10) days after approval of the Subcontractors and Material Suppliers Lists.
   2. Other unavailability will be considered only as being due to strikes, lockouts, bankruptcy, or discontinuance of manufacture.
   3. Any approved substitutions shall be incorporated into the Contract by Change Order.

3.02 OWNER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:

1. Review Owner reviewed shop drawings, product data, and samples.
2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide off-site storage and protection when site does not permit on-site storage or protection.

G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

H. Comply with manufacturer's warranty conditions, if any.

I. Do not store products directly on the ground.

J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

K. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

L. Prevent contact with material that may cause corrosion, discoloration, or staining.

M. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

N. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

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SUBSTITUTION REQUEST

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

Attn: _____ A/E Project No.: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page and Paragraph: _____

Proposed Substitution: _____

Trade Name: _____

Manufacturer: _____ Model No.: _____

Mfg. Address _____ City, State, zip: _____ Phone: _____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the date are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____ E-mail: _____

A/E's REVIEW AND ACTION

- ☐ Substitution approved - Make submittals in accordance with Specifications, Substitution Procedures.
- ☐ Substitution approved as noted - Make submittals in accordance with Specifications Substitution Procedures.
- ☐ Substitution rejected - Use specified materials.
- ☐ Substitution Request received too late - Use specified materials.

Signed by: Date:

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

INCOMPLETE INFORMATION WILL BE GROUNDS FOR REJECTION

SECTION 01 7000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

G. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

B. Section 01 4000 - Quality Requirements: Testing and inspection procedures.

C. Section : Project record documents, operation and maintenance data, warranties, and bonds.

D. Section 02 4100 - Demolition: Selective demolition of building elements for alterations purposes.

E. Individual Product Specification Sections:
   1. Advance notification to other sections of openings required in work of those sections.
   2. Limitations on cutting structural members.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
   2. Identify demolition firm and submit qualifications.
   3. Include a summary of safety procedures.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.
   6. Include in request:
      a. Identification of Project.
      b. Location and description of affected work.
      c. Necessity for cutting or alteration.
      d. Description of proposed work and products to be used.
      e. Alternatives to cutting and patching.
      f. Effect on work of Owner or separate Contractor.

g. Written permission of affected separate Contractor.
h. Date and time work will be executed.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

A. For survey work, employ a Professional Land Surveyor licensed in the State in which the Project is located and acceptable to Architect. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

C. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.06 PROJECT CONDITIONS

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water.

C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
1. Minimize amount of bare soil exposed at one time.
2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

G. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

H. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
1. Contractor shall schedule ordering of products, taking lead-times into account, and shall be responsible for any cost associated with expediting delivery of specified items in order to keep project on schedule.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner-occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 - PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
   1. Every trade shall examine substrate to determine if it is adequate to receive the work of that section prior to initiating work.
   2. Notify Contractor of any deficiencies needing correction.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

E. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

F. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

G. Utilize Standards of Practice for Professional Land Surveyors.

H. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.

I. Periodically verify layouts by same means.

J. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-conforming work.

C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

D. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

F. Restore work with new products in accordance with requirements of Contract Documents.

G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

I. Patching:
   1. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.
   2. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   3. Match color, texture, and appearance.
   4. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Prohibit traffic from landscaped areas.

H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.09 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

B. Testing, adjusting, and balancing HVAC systems: See appropriate Division 23 Section.

3.10 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Use cleaning materials that are nonhazardous.

C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Replace filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.11 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect.

B. The Contractor shall generate and provide a punch-list to the Architect prior to requesting inspection for substantial completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Accompany Architect on Contractor's preliminary final inspection.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.12 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

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SECTION 01 7419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, incineration, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.

E. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.

F. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

C. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

D. Section : Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

1. Return: To give back reusable items or unused products to vendors for credit.

I. Reuse: To reuse a construction waste material in some manner on the project site.

J. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

K. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

L. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

M. Toxic: Poisonous to humans either immediately or after a long period of exposure.

N. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

O. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
   1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
   2. Submit Report on a form acceptable to Owner.
   3. Landfill Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project disposed of in landfills.
      c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   4. Incinerator Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project delivered to incinerators.
      c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   5. Recycled and Salvaged Materials: Include the following information for each:
      a. Identification of material, including those retrieved by installer for use on other projects.
      b. Amount, in tons or cubic yards (cubic meters), date removed from the project site, and receiving party.
      c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
      e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
   6. Material Reused on Project: Include the following information for each:
      a. Identification of material and how it was used in the project.
      b. Amount, in tons or cubic yards (cubic meters).
      c. Include weight tickets as evidence of quantity.

d. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

A. See Section 01 6000 - Product Requirements for substitution submission procedures.

B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 6000:
   1. Relative amount of waste produced, compared to specified product.
   2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Sum.
   3. Proposed disposal method for waste product.
   4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.

C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.

D. See Section for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
   1. Pre-bid meeting.
   2. Pre-construction meeting.
   3. Regular job-site meetings.
   4. Job safety meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. As a minimum, provide:
      a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
      b. Separate dumpsters for each category of recyclable.
      c. Recycling bins at worker lunch area.
   2. Provide containers as required.
   3. Provide temporary enclosures around piles of separated materials to be recycled or salvaged.
   4. Provide materials for barriers and enclosures that are nonhazardous, recyclable, or reusable to the maximum extent possible; reuse project construction waste materials if possible.

5. Locate enclosures out of the way of construction traffic.
6. Provide adequate space for pick-up and delivery and convenience to subcontractors.
7. If an enclosed area is not provided, clearly lay out and label a specific area on-site.
8. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.

B. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment. All record documents, warranties and O&M manuals are to be submitted in paper format (1 copy) along with 1 digital download of PDF's of the documents.

B. At completion of Project, the Contractor shall submit to Architect a complete set of clearly marked-up Project Documents, as follows:
   1. One (1) Original Set clearly marked as-built, record drawings and specifications.
   2. One (1) Digitally Downloadable Version: With as-built record drawings and as-built record specifications along with O&M Manuals and Warranties.

C. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit one paper set and one digital download of revised final documents in final form within 10 days after final inspection, each with as-built record drawings and as-built record specifications along with O&M Manuals and Warranties as referenced above.

D. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
   4. Submit digital download of as-built record drawings and as-built record specifications along with O&M Manuals and Warranties as referenced above.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured depths of foundations in relation to finish first floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract drawings.

G. Scan marked-up Record Drawings and Specifications onto a digitally downloadable file (with as-built record drawings and as-built record specifications).

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.
2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

F. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Include color coded wiring diagrams as installed.

E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

G. Provide servicing and lubrication schedule, and list of lubricants required.

H. Include manufacturer's printed operation and maintenance instructions.
   1. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Provide control diagrams by controls manufacturer as installed.

K. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Include test and balancing reports.

O. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

D. Prepare data in the form of an instructional manual.

E. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

F. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

G. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

H. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

I. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

J. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

L. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.

M. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Certificates.

N. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

O. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Manual: Bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) three D side ring binders with durable plastic covers.

F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

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SECTION 02 3213
SUBSURFACE INVESTIGATION

PART 1 - GENERAL

1.01 GENERAL

A. Subsurface investigation was conducted, and a report (Geotechnical Exploration dated September 9, 2025, GMC Project No. GBHM250037) was issued by:
   1. GOODWYN MILLS CAWOOD, LLC.
   2. Michael McNeil, P.E.
   3. 2400 5th Avenue South, Suite 200
   4. Birmingham, AL 35233
   5. Phone: (205) 879-4462

B. The investigations are performed to assist the Architect and Consulting Engineers in the design of the project and are available to the Contractor as available information only.

C. The Reports will be available for review at the Architect's offices.

D. One (1) copy of the reports will be furnished to any General Contractor bidding this project who requests it, and to any Plan Rooms listed that request it.

E. Upon request, properly qualified Subcontractors for Earthwork will also be provided one (1) copy of the reports.

F. The reports *are not part of the Contract Documents.*

G. Interpretation:
   1. Bidders shall make their own investigation of subsurface conditions, for neither the Owner nor the Architect assumes responsibility for the accuracy or completeness of the information contained in the report, nor will the Owner or the Architect be responsible for the additional compensation for work performed on the basis of Bidders' assumptions based on the report.
   2. Note however, that it is expected that Contractors will utilize the Owner's Reports of "Geotechnical Subsurface Investigation" (or similar name) much the same as have the Architect and Engineers. However, as indicated, neither the Owner nor the Architect accept any responsibility whatsoever for the information contained in the reports, nor for any interpretations others make based on the information contained therein.
      a. In the event of unforeseen existing conditions encountered during the Work of the project, there are provisions within the Contract Documents to compensate the Contractor for any required and properly authorized additional work.

H. Refer to other Sections of the Project Manual and the Drawings for additional information and requirements.

PART 2 - PRODUCTS

2.01 NOT APPLICABLE TO THIS SECTION.

PART 3 - EXECUTION

3.01 NOT APPLICABLE TO THIS SECTION.

END OF SECTION

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SECTION 02 4100

DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Selective demolition of built site elements.

B. Abandonment and removal of existing utilities and utility structures.

1.2 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 01 1000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.

C. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

D. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

E. Section 01 7000 – Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

F. Section 31 1000 - Site Clearing: Vegetation and existing debris removal.

G. Section 31 2000 – Earth Moving: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.3 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2004.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Site Plan: Showing:

1. Areas for temporary construction and field offices.

2. Areas for temporary and permanent placement of removed materials.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.

1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.

2. Identify demolition firm and submit qualifications.

3. Include a summary of safety procedures.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.5 QUALITY ASSURANCE

A. Demolition Firm Qualifications:

1. Company specializing in the type of work required.

B. Regulatory Requirements: Comply with governing EPA notification regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

1. Where required by local Health Department or other authorities having jurisdiction, provide certificate of pest and rodent eradication and subsequent inspection completed prior to and after building demolition.

C. Pre-demolition Conference: Demolition will be reviewed at required Preconstruction Conference for the Project.

1. In addition, conduct pre-demolition conferences at Project site with Owner's representatives, to provide final notice to and coordination with Owner's representatives and on-site personnel.

D. Notices: Contractor shall provide all notices required by Code, applicable regulations, ordinances and/or local and other authorities having jurisdiction.

1. All notices shall be in writing, with copies provided to the Owner and Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill Material: As specified in Section 31 2000 – Earth Moving.

PART 3 – EXECUTION

3.1 SCOPE

A. Extent of demolition is indicated on the Plan.

B. Remove paving and curbs as required to accomplish new work.

C. Remove items indicated

D. Remove other items indicated, for salvage, relocation, and recycling.

E. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 2000.

F. Salvage, relocate, or recycle as directed and as applicable.

a. The Owner reserves the right of first refusal for any structures, materials, and/or accessory items on site or within the buildings including, but not limited to, fire alarm panels and accessories, door hardware, electrical transformers, copper tubing, onsite trees and shrubs, and other items of value that may or may not be shown on the plans or called out in the project manual. Any items removed from the site without prior approval from the Owner will be paid to the Owner by the contractor at two times (2x) the market value.

G. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as required so that required rough grade elevations do not subside within one year after completion.

3.2 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.

1. Obtain required permits.

2. Comply with applicable requirements of NFPA 241.

3. Use of explosives is not permitted.

4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.

5. Provide, erect, and maintain temporary barriers and security devices.

6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.

7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.

8. Do not close or obstruct roadways or sidewalks without permit.

9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.

10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of Notification To Proceed from Owner.

C. Do not begin removal until built elements to be salvaged or relocated have been removed and delivered to a location as directed by the Owner.

D. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.

E. Protect existing structures and other elements that are not to be removed.

1. Provide bracing and shoring.

2. Prevent movement or settlement of adjacent structures.

3. Stop work immediately if adjacent structures appear to be in danger.

F. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

G. If hazardous materials are discovered during removal operations, stop work and notify Engineer and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

1. Removal of asbestos shall be subject to state and local regulatory requirements.

H. Perform demolition in a manner that maximizes salvage and recycling of materials.

1. Dismantle existing construction and separate materials.

2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

I. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.3 EXISTING UTILITIES

A. Coordinate work with utility companies.
   1. The locations of existing underground utilities are shown in an approximate manner only. The Contractor shall determine exact location of all existing utilities before commencing work. The contractor shall be fully responsible for any and all damages which might be occasioned by his failure to exactly locate and preserve any and all underground utilities. The Contractor shall contact Alabama One Call (811) a minimum of 48 hours prior to excavation. If no paint is visible, Contractor shall not perform excavation until verifying with that work site is cleared for excavation.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 5 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.4 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.

   1. Verify that construction and utility arrangements are as shown.

   2. Report discrepancies to Engineer or Engineers before disturbing existing installation.

   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Remove existing work as indicated and as required to accomplish new work.

   1. Remove items indicated on drawings.

C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.

   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.

2. Where existing active systems serve occupied facilities, but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.

3. Verify that abandoned services serve only abandoned facilities before removal.

4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

E. Protect existing work to remain.

1. Prevent movement of structure; provide shoring and bracing if necessary.

2. Perform cutting to accomplish removals neatly and as specified for cutting new work.

3. Repair adjacent construction and finishes damaged during removal work.

4. Patch as specified for patching new work.

3.5 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash and legally dispose of off-site.

B. Remove from site all materials not to be reused on site; do not burn or bury.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

END OF DEMOLITION



04/27/2026

FOR SPECIFICATION SECTIONS
01 4100, 03 3100, 05 1200, 05 3100, AND 05 4500

SECTION 03 3100

CONCRETE

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:

1. Formwork.
2. Reinforcing.
3. Cast-in place concrete including mix design, placement procedures, and finishes.

B. Cast-in-place concrete includes the following:

1. Foundations and footings.
2. Slabs-on-grade.
3. Equipment pads and bases.

C. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

D. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 02 2000, "Earthwork": Drainage fill under slabs on grade.
2. Section 02 5140, "Portland Cement Concrete Paving": Concrete paving and walks.
3. Section 03 3500, “Concrete Toppings”
4. Section 03 4100, “Structural Precast Concrete”
5. Section 04 2000, "Unit Masonry": Concrete fill for masonry lintels.
6. Section 05 5000, "Metal Fabrications": Metal items to be built into concrete.
7. Section 07 9000, "Sealants and Joint Fillers": Sealants and joint fillers in concrete work.
8. Section 09 6260, “Resilient Athletic Flooring”
9. Respective Sections of Division 15 and 16, as applicable, for furnishing of inserts, anchorage and erection items required for mechanical and electrical work..
10. Divisions 15 and 16, as applicable, for furnishing and setting of conduit, pipes and sleeves for mechanical and electrical equipment.

1.2 SUBMITTALS:

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect.

C. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and

arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.

D. Samples of materials as requested by Architect, including names, sources, and descriptions, as follows:

1. Color finishes.
2. Normal weight aggregates.
3. Reglets.
4. Waterstops.
5. Vapor retarder/barrier.

E. Laboratory test reports for concrete materials and mix design test.

F. Minutes of pre-installation conference.

1.3 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. ACI 301, "Specifications for Structural Concrete for Buildings".
2. ACI 302, "Guide for Concrete Floor and Slab Construction".
3. ACI 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".
4. ACI 305, "Hot Weather Concreting".
5. ACI 306, "Cold Weather Concreting".
6. ACI 309, "Guide for Consolidation of Concrete".
7. ACI 311, "Recommended Practice for Concrete Inspection".
8. ACI 318, "Building Code Requirements for Reinforced Concrete".
9. ACI 347, "Recommended Practice for Concrete Formwork".
10. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."
11. American Welding Society, AWS D1.4 "Structural Welding Code - Reinforcing Steel".

B. Concrete Testing Service: Engage a testing agency acceptable to Architect to perform material evaluation tests and to design concrete mixes.

C. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings" and the following:

1. At least 35 days prior to submitting design mixes, conduct a meeting to review detailed requirements for preparing concrete design mixes and to determine procedures for satisfactory concrete operations. Review requirements for submittals, status of coordinating work, and availability of materials. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications. Require representatives of each entity directly concerned with cast-in-place concrete to attend conference, including, but not limited to, the following:

a. Contractor's superintendent.
b. Agency responsible for concrete design mixes.
c. Agency responsible for field quality control.
d. Ready-mix concrete producer.
e. Concrete subcontractor.
f. Primary admixture manufacturers.

PART 2 - PRODUCTS

2.1 FORM MATERIALS:

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

1. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form," Class I.

2. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Form Liner: Pattern 16020 Rough Sawn Plank, Rough Grain Plank, horizontal orientation by Fitzgerald Formliners, or equal – Concrete walls at monumental stair. Coordinate location with architectural drawings.

D. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

E. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to the plane of the exposed concrete surface.

F. Provide ties that, when removed, will leave holes not larger than 1 inch in diameter in the concrete surface.

2.2 REINFORCING MATERIALS:

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Steel Wire: ASTM A 82, plain, cold-drawn steel.

C. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

D. Deformed-Steel Welded Wire Fabric: ASTM A 497.

E. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

F. Threaded Dowels: Continuous threaded high-strength steel bars equal to "Lasstud" by Richmond Screw Anchor Co., Inc. Provide inserts compatible with dowels, designed for ultimate pull-out force indicated on the drawings.

G. Mechanical Splices: Equal to "Cadweld Rebar Splices", as manufactured by Erico Products, Inc., "C" Series, for developing 125% of minimum ASTM specified yield strengths, unless otherwise noted on drawings.

H. Steel Shapes, Plates and Rods: Conform to ASTM A 36, "Specification for Structural Steel".

I. Do Not Weld Reinforcing Steel: Unless specifically noted on drawings. If welding is shown, conform to latest revision of AWS D12.1, "Reinforcing Steel Welding Code of the American Welding Society". Perform all welding with certified welders qualified per AWS.

2.3 CONCRETE MATERIALS:

A. Portland Cement: ASTM C 150, Type I.

1. Use one brand of cement throughout Project unless otherwise acceptable to Architect.

B. Fly Ash: ASTM C 618, Type F or C.

1. Limit use of fly ash to not exceed 20 percent of cement content by weight.

C. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.

1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.

D. Water: Potable.

E. Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other

required admixtures.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Air-Tite, Cormix Construction Chemicals.
   b. Air-Mix or Perma-Air, Euclid Chemical Co.
   c. Darex AEA or Daravair, W.R. Grace & Co.
   d. MB-VR or Micro-Air, Master Builders, Inc.
   e. Sealtight AEA, W.R. Meadows, Inc.
   f. Sika AER, Sika Corp.

G. Water-Reducing Admixture: ASTM C 494, Type A.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. PSI N, Cormix Construction Chemicals.
   b. Eucon WR-75, Euclid Chemical Co.
   c. WRDA, W.R. Grace & Co.
   d. Pozzolith Normal or Polyheed, Master Builders, Inc.
   e. Plastocrete 161, Sika Corp.

H. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Eucon 37, Euclid Chemical Co.
   b. WRDA 19 or Daracem, W.R. Grace & Co.
   c. Rheobuild or Polyheed, Master Builders, Inc.
   d. Sikament 300, Sika Corp.

I. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Accelguard 80, Euclid Chemical Co.
   b. Daraset, W.R. Grace & Co.
   c. Pozzutec 20, Master Builders, Inc.

J. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Eucon Retarder 75, Euclid Chemical Co.
   b. Daratard-17, W.R. Grace & Co.
   c. Pozzolith R, Master Builders, Inc.
   d. Protard, Prokrete Industries.
   e. Plastiment, Sika Corporation.

2.4 RELATED MATERIALS:

A. Reglets: Where sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.0217-inch-thick (26-gage) galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

B. Vapor Barrier:

1. Vapor Barrier, General Use (except as indicated below):

    a. Product: Plastic vapor barrier. Include manufacturer's recommended adhesive or pressure-sensitive tape for sealing joints, laps and penetrations, preformed boots for penetrations, and all other components required for a complete, proper and vaporproof installation in accordance with ASTM E1643.
        1) Classification: Must exceed ASTM E 1745 Class "A".
        2) Permeance: ASTM E96: 0.02 perms or less.
        3) Thickness: Not less than 15 mils.

    b. Manufacturer/Product:
        1) "Moistop Ultra 15 mil", Fortifiber Building Systems Group.
        2) "Perminator 15 mil", W.R. Meadows
        3) "Griffolyn Type-105", Reef Industries, Inc.
        4) "Stego Wrap 15 mil", Stego Industries, LLC.
        5) "VaporBlock VB15", Raven Inc.
        6) "Husky Yellow Guard 15 mil", Poly-America, L.P.

    c. "Locations for Use: Continuous below all new and opened building slabs, and other structural slabs, porches, stoops, pads, covered (below roofs) areas, etc., on grade, and turned-down to tops of footings.

2. Vapor Barrier, **Below Wood Flooring**: Provide below and 5'-0" beyond all wood flooring; Premolded seven-ply membrane consisting of reinforced core and carrier sheet with fortified bitumen layers, protective weathercoating, and plastic anti-stick sheet. Provide manufacturer's recommended mastics and gusset tape.

    a. Product/Manufacturer: Subject to compliance with requirements, provide "Premoulded Membrane Vapor Seal with Plasmatic Core," as manufactured by W.R. Meadows, Inc.; Austell, GA.
    b. Locations for Use: Continuous below and 5'-0" beyond all wood flooring.

C. Nonslip Aggregate Finish: Provide fused aluminum oxide granules or crushed emery as the abrasive aggregate for a nonslip finish, with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof, nonglazing, and unaffected by freezing, moisture, and cleaning materials.

D. Colored Wear-Resistant Finish: Packaged dry combination of materials consisting of portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground nonfading mineral oxides interground with cement. Color as selected by Architect from manufacturers' standards, unless otherwise indicated.

1. Products: Subject to compliance with requirements, provide one of the following:
    a. Quartz Tuff, Dayton-Superior.
    b. Surflex, Euclid Chemical Co.
    c. Colorundum, A.C. Horn, Inc.
    d. Quartz Plate, L&M Construction Chemicals, Inc.
    e. Colorcron, Master Builders, Inc.
    f. Lithochrome Color Hardener, L.M. Scofield Co.
    g. Harcol Redi-Mix, Sonneborn-Chemrex.
    h. Hard Top, Symons Corp.

E. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

F. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.

G. Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.55 kg/sq. meter when applied at 200 sq. ft./gal.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Spartan-Cote, The Burke Co.
   b. Day-Chem Cure and Seal, Dayton Superior Corp.
   c. Eucocure, Euclid Chemical Co.
   d. Horn Clear Seal, A.C. Horn, Inc.
   e. L&M Cure R, L&M Construction Chemicals, Inc.
   f. Masterkure, Master Builders, Inc.
   g. CS-309, W.R. Meadows, Inc.
   h. Kure-N-Seal, Sonneborn-Chemrex.

H. Water-Based Acrylic Membrane Curing Compound: ASTM C 309, Type I, Class B.

1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Sealco - VOC, Cormix Construction Chemicals.
   b. Safe Cure and Seal, Dayton Superior Corp.
   c. Aqua-Cure, Euclid Chemical Co.
   d. Dress & Seal WB, L&M Construction Chemicals, Inc.
   e. Masterkure 100W, Master Builders, Inc.
   f. Vocomp-20, W.R. Meadows, Inc.

I. V.O.C. Compliant Acrylic Curing and Sealing Type (30 Percent): Liquid type membrane-forming curing compound complying with ASTM C 309, Type 1, Class A and B. Provide 30 percent solids minimum, for surfaces indicated to be sealed.

J. Safe Cure and Seal: 30 percent (J-19), Dayton Superior Inc.

K. Evaporation Control:

1. Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1. Eucobar, Euclid Chemical Co.
      2. E-Con, L&M Construction Chemicals, Inc.
      3. Confilm, Master Builders, Inc.

L. V.O.C. Compliant Evaporation Control: Sure Film (J-74), Dayton Superior Inc.

M. Underlayment Compound: Free-flowing, self-leveling, pumpable, cement-based compound for applications from 1 inch thick to feathered edges.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. K-15, Ardex, Inc.
   b. LevelLayer II, Dayton Superior Corp.
   c. Flo-Top, Euclid Chemical Co.
   d. Gyp-Crete, Gyp-Crete Corp.
   e. Levelex, L&M Construction Chemicals, Inc.
   f. Underlayment 110, Master Builders, Inc.
   g. Thoro Underlayment Self-Leveling, Thoro System Products.

N. Bonding Agent: Polyvinyl acetate or acrylic base.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Polyvinyl Acetate (Interior Only):
      1. Superior Concrete Bonder, Dayton Superior Corp.
      2. Euco Weld, Euclid Chemical Co.
      3. Weld-Crete, Larsen Products Corp.
      4. Everweld, L&M Construction Chemicals, Inc.
      5. Ready Bond, Symons Corp.
   b. Acrylic or Styrene Butadiene:
      1. Acrylic Bondcrete, The Burke Co.
      2. Day-Chem Ad Bond, Dayton Superior Corp.
      3. SBR Latex, Euclid Chemical Co.
      4. Daraweld C, W.R. Grace & Co.
      5. Hornweld, A.C. Horn, Inc.
      6. Everbond, L&M Construction Chemicals, Inc.
      7. Acryl-Set, Master Builders Inc.
      8. Intralok, W.R. Meadows, Inc.
      9. Sonocrete, Sonneborn-Chemrex.

O. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Resi-Bond (J-58), Dayton Superior.
   b. Euco Epoxy System #452 or #620, Euclid Chemical Co.
   c. Epoxtite Binder 2390, A.C. Horn, Inc.
   d. Epabond, L&M Construction Chemicals, Inc.
   e. Concresive Standard Liquid, Master Builders, Inc.
   f. Rezi-Weld 1000, W.R. Meadows, Inc.
   g. Sikadur 32 Hi-Mod, Sika Corp.

P. Interior Epoxy Sealer: Use a maximum 35 percent type.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Epoxy-Plus; Dayton Superior Inc.
   b. Eucopoxy 1; Euclid Chemical
   c. Oauerseal 30E; Non-Crete, Inc.
   d. Rescon R117; Symons Corp.
   e. Son-No-Mar; Sonneborn, Div./Chem Rex Inc.
   f. Super Seal 35; L & M Const. Chem. Co.

Q. V.O.C. Compliant Urethane Sealer:

1. Day Chem Urethane V.O.C. (J-39); Dayton Superior Inc.

2.5 PROPORTIONING AND DESIGNING MIXES:

A. Prepare design mixes for each type and strength of concrete by either laboratory trial mixtures or field experience methods as specified in ACI 318-05 Section 5.3. If trial mixtures method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing, unless otherwise acceptable to Architect.

B. Trial mix designs and strength tests, made by qualified independent material laboratory, in accordance with ACI 318-05 Section 5.3 are required for the following types of concrete:

1. Normal weight concrete with specified strength in excess of 4000 psi.
2. All concrete designs for which a suitable experience record is not available.

C. Mix design based on a record of past performance in accordance with ACI 318-05 Section 5.3, may be provided by qualified concrete supplier or precast concrete manufacturer for concrete designs. Mix design shall be certified by an independent testing laboratory.

D. All concrete mix designs shall include the following information:

1. Proportions of cement, fine and coarse aggregate and water.
2. Water/cement ratio, design strength, slump and air content.
3. Type of cement and aggregates.
4. Type and dosage of all admixtures.
5. Type, color and dosage of integral coloring compounds, where applicable.
6. Special requirements for pumping.
7. Any special characteristics of the mix which require precautions in the mixing, placing or finishing techniques to achieve the finished product specified.

E. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect.

F. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:

1. Subjected to freezing and thawing: W/C 0.45.
2. Subjected to deicers/watertight: W/C 0.40.

3. Subjected to brackish water, salt spray, or deicers: W/C 0.40.

G. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps and sloping surfaces: Not more than 3 inches.
2. Reinforced foundation systems: Not less than 1 inch and not more than 3 inches.
3. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2-to-3-inch slump concrete.
4. Other concrete: Not less than 3 inches and not more than 5 inches.

2.6 ADMIXTURES:

A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg.F (10 deg.C).

C. Use high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.

D. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:

1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:
   a. 4.5 percent (moderate exposure); 5.5 percent (severe exposure) for 1-1/2-inch maximum aggregate.
   b. 4.5 percent (moderate exposure); 6.0 percent (severe exposure) for 1-inch maximum aggregate.
   c. 5.0 percent (moderate exposure); 6.0 percent (severe exposure) for 3/4-inch maximum aggregate.
   d. 5.5 percent (moderate exposure); 7.0 percent (severe exposure) for 1/2-inch maximum aggregate.
2. Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener: 2 to 4 percent air.

E. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.

1. When air temperature is between 85 deg.F (30 deg.C) and 90 deg.F (32 deg.C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg.F (32 deg.C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 GENERAL:

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.2 FORMS:

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

1. Provide Class A tolerances for concrete surfaces exposed to view.
2. Provide Class C tolerances for other concrete surfaces.

B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.3 VAPOR RETARDER/BARRIER INSTALLATION:

A. General: Place vapor retarder/barrier sheeting in position with longest dimension parallel with direction of pour.

B. Lap vapor barrier over footings and/or seal to foundation walls.

C. Lap joints 6 inches and seal with manufacturer's recommended mastic or pressure-sensitive tape.

D. Seal all penetrations (including pipes) per manufacturer’s instructions.

E. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.

F. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.

3.4 PLACING REINFORCEMENT:

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.

1. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect.

D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS:

A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Architect.

B. Provide keyways at least 1-1/2 inches deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across

construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

E. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Joint fillers and sealants are specified in Section 07900, "Sealants and Joint Fillers".

F. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts 1/8 inch wide by one-fourth of slab depth or inserts 1/4 inch wide by one-fourth of slab depth, unless otherwise indicated.

1. Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
3. If joint pattern is not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
4. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

3.6 INSTALLING EMBEDDED ITEMS:

A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

B. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.

C. Install dovetail anchor slots in concrete structures as indicated on drawings.

D. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.7 PREPARING FORM SURFACES:

A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

1. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.8 CONCRETE PLACEMENT:

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
3. Maintain reinforcing in proper position on chairs during concrete placement.

F. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

G. When air temperature has fallen to or is expected to fall below 40 deg.F (4 deg.C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg.F (10 deg.C) and not more than 80 deg.F (27 deg.C) at point of placement.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete

on frozen subgrade or on subgrade containing frozen materials.

2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg.F (32 deg.C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.

3.9 FINISHING FORMED SURFACES:

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Smooth-Rubbed Finish: Provide smooth-rubbed finish on scheduled concrete surfaces that have received smooth-formed finish treatment not later than 1 day after form removal.

1. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 MONOLITHIC SLAB FINISHES:

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor

topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.

1. After placing slabs, finish surface to tolerances specified in Section 3.11. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances specified in Section 3.11. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.

1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances specified in Section 3.11. Grind smooth any surface defects that would telegraph through applied floor covering system.

D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.

E. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

F. Colored Wear-Resistant Finish: Apply a colored wear-resistant finish to monolithic slab surface indicated.

1. Apply dry shake materials for the colored wear-resistant finish at a rate of 100 lb per 100 sq. ft., unless a greater amount is recommended by material manufacturer.
2. Cast a trial slab approximately 10 feet square to determine actual application rate, color, and finish, as acceptable to Architect.
3. Immediately following the first floating operation, uniformly distribute with mechanical spreader approximately two-thirds of the required weight of the dry shake material over

the concrete surface, and embed by power floating. Follow floating operation with second shake application, uniformly distributing remainder of dry shake material with overlapping applications to ensure uniform color, and embed by power floating.

4. After broadcasting and floating, apply a trowel finish as specified. Cure slab surface with a curing compound recommended by the dry shake material manufacturer. Apply the curing compound immediately after the final finishing.

3.11 FLOOR FLATNESS/LEVELNESS REQUIREMENTS:

A. After placing slabs, finish surface to the following tolerances of F(F) (floor flatness) and F(L) (floor levelness) measured according to ASTM E 1155:

FINISH	SLAB-ON-GRADE				FRAMED FLOOR	
	OVERALL		LOCAL		OVERALL	LOCAL
	FF	FL	FF	FL	FF	FF
Scratch Finish	18	15	15	13	25	22
Float Finish	20	17	18	15	25	22
Trowel Finish	25	22	20	17	25	22

Specified overall F-numbers apply to the whole floor, taken as one. Minimum local F-numbers apply to each slab, bounded by construction joints.

3.12 MISCELLANEOUS CONCRETE ITEMS:

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.13 CONCRETE CURING AND PROTECTION:

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. No curing agents or sealers are to be applied to the concrete slab where Resilient Athletic Flooring is scheduled.

C. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

D. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

1. Provide moisture curing by the following methods:

a. Keep concrete surface continuously wet by covering with water.
b. Use continuous water-fog spray.
c. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.

2. Provide moisture-retaining cover curing as follows:
a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:
a. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
b. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

E. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

F. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.

1. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.14 REMOVING FORMS:

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg.F (10 deg.C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75

percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.15 REUSING FORMS:

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Architect.

3.16 CONCRETE SURFACE REPAIRS:

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Architect.

B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

1. Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.

2. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and

smoothness by using a template having the required slope.

1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.
4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.

F. Repair methods not specified above may be used, subject to acceptance of Architect.

3.17 QUALITY CONTROL TESTING DURING CONSTRUCTION:

A. General: The Owner will employ a testing agency to perform tests and to submit test reports.

B. Sampling and testing for quality control during concrete placement may include the following, as directed by Architect.

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
   a. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
   b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
   c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg.F (4 deg.C) and below, when 80 deg.F (27 deg.C) and above, and one test for each set of compressive-strength specimens.
   d. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.

C. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in

any one day, or for each 5000 sq ft of surface are placed; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

1. Any additional cylinder required by the Contractor for early strength gain tests for form stripping or post-tensioning are Contractor's responsibility and shall be paid for by Contractor.
2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
3. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive strength testing if adequate evidence of satisfactory strength is provided.
4. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.
6. Test results will be reported in writing to Architect, Structural Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.
7. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
8. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF CONCRETE

SECTION 03 3931
CURING, SEALING AND HARDENING CONCRETE FLOORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Floors denoted on Finish Schedule as SC (Sealed Concrete).

B. Related Sections
   1. Drawings and general provisions of Contract, including General Conditions and Division 1 Specification Sections, apply to the work of this Section.
   2. Section 03 3100 - Concrete.

1.02 SUBMITTALS

A. Contractor shall submit specified manufacturer's complete technical data sheets for all products to be used, including installation instructions.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of specified sealer shall have a minimum 10 years experience in the production of the specified products.

B. Contractor Qualifications: Contractor must have a minimum 3 years experience in sealing applications and successfully completed not less than 6 projects comparable in scale and complexity.

C. Regulatory Requirements
   1. Products shall comply with the United States Clean Air Act for maximum Volatile Organic Compound (VOC) content as specified in PART 2 of this section.

D. Mockups and Field Samples: Prepare field sample at project site for architects review and approval.
   1. Include Curing, Sealing and Hardening Concrete Floors in Mock-Up as described in Section 01 4000 - Quality Requirements.
   2. Samples shall be constructed on site and shall be 4'x4'. If there is existing concrete, the Architect shall select an area where the samples will be placed.
   3. Construct sample-using processes and techniques intended for use on permanent work, including curing procedures. Include samples of control, construction, and expansion joints in sample panels.
   4. Sample shall be sealed by the individual workers who will actually be performing the work for the project.
   5. Obtain written approval of the sample from project Architect before start of work.
   6. Retain approved samples through completion of the work for use as a quality standard for finished work.
   7. The mockup may remain part of the finished work if approved.

E. Mandatory Pre Pour Installation Conference: Conduct conference at project site to comply with requirements in Division 1 Sections “Special Conditions” and “Administrative Requirements”.
   1. The mandatory preinstallation conference shall occur prior to any concrete pours.
   2. The purpose of the mandatory preinstallation conference is to review the criteria with the General Contractor, concrete subcontractor, concrete finish manufacturer, and concrete finish installer.
   3. The meeting shall establish the following:
      a. Roles and expectations of each subcontractor.
      b. Days and times of concrete pour schedules.
      c. Sequencing of operations for pouring, curing, finishing and protection of finished concrete surfaces.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver the specified products in original, unopened containers with legible manufacturer's identification and information.

B. Store specified products in conditions recommended by the manufacturer.

1.05 JOB SITE CONDITIONS

A. Environmental Conditions: Maintain an ambient temperature of between 50° F and 90° F during application and at least 48 hours after application.

B. Protection: Precautions shall be taken to avoid damage or contamination of any surfaces near the work zone. Protect completed stain work from moisture or contamination.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Prosoco, Inc.: www.prosoco.com.

B. Dayton Superior Corporation: www.daytonsuperior.com.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PRODUCTS

A. Consolideck LS/CS lithium silicate sealer, hardener & densifier for concrete [Basis of Design]: www.prosoco.com.
   1. Provide with protection and sheen enhancer coat. LSGuard by Prosoco [Basis of Design].

B. Pentra-Hard Densifier lithium silicate densifier, sealer, dustproofer and hardener for concrete: www.daytonsuperior.com.
   1. Provide with protection and sheen enhancer coat recommended by manufacturer.

C. Substitutions: The use of any products other than those specified will be considered providing that the contractor requests its use in writing within fourteen (14) days prior to bid date. This request shall be accompanied by:
   1. A certificate of compliance from the material manufacturer stating that the proposed products meet or exceed the requirements for this specification.
   2. Documented proof that the proposed material has a five (5) year proven record of performance for sealing, hardening and densifying concrete substrates, confirmed by at least two (2) local projects that the Architect can examine.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Contractor shall examine areas and conditions under which work will be performed and identify conditions detrimental to proper and timely completion of work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. New Concrete
   1. Apply sealer/densifier immediately after final finishing and installation of control joints (if manufacturer's recommendations permit); when the concrete surface won't be marred by foot traffic and after joints have been cut and cleaned or anytime thereafter. Remove soft cut saw debris prior to applying sealer/densifier. Surface shall be swept, and mopped or pressure-washed as necessary to insure no dirt, grit, trash, or similar items mar finished product. Remove all markings, including paint, marker or pencil marks. Inspect floor surface prior to application to be sure it is ready for sealer/densifier.

B. Existing Concrete
   1. Remove all dirt, debris, or curing compounds using appropriate surface prep cleaner. Allow cleaning waters used in surface preparation to dry.

3.03 APPLICATION OF SEALER

A. New Concrete
   1. The surface shall be sealed with a sealer produced of the type specified under Products above.
      a. Also apply manufacturer's protection coat as specified above.
   2. Apply at the rates and method recommended by manufacturer in written instructions which the installer shall have at the job site.
   3. Apply a single coat using low pressure sprayer fitted with 0.5 gal/min spray tip. Lightly apply sufficient product to wet the surface without producing puddles. Use clean, soft bristle push broom or microfiber pad to spread the product evenly and ensure uniform wetting. Avoid spreading once drying begins. Scrubbing is not necessary.
   4. If surfaces dry immediately, increase the rate of application. Surfaces should remain wet 5 to 10 minutes. Adjust rate of application to eliminate puddles. Any white residue must be removed immediately.
   5. Allow treated surfaces to dry.
   6. For uncured steel troweled concrete, immediately apply the specified curing compound or initiate specified curing procedure.
   7. When the curing process is complete, use an automatic floor scrubber equipped with cleaning pads or brushes appropriate for removal of accumulated construction soiling and surface residues. Avoid pads or brushes which may damage the finished floor.

B. Existing Concrete
   1. The surface shall be sealed with a sealer produced of the type specified under Products above.
      a. Also apply manufacturer's protection coat as specified above.
   2. Apply at the rates and method recommended by manufacturer in written instructions which the installer shall have at the job site.
   3. Apply a single coat using low pressure sprayer fitted with 0.5 gal/min spray tip. Lightly apply sufficient product to wet the surface without producing puddles. Use clean, soft bristle push broom or microfiber pad to spread the product evenly and ensure uniform wetting. Avoid spreading once drying begins. Scrubbing is not necessary.
   4. If surfaces dry immediately, increase the rate of application. Surfaces should remain wet 5 to 10 minutes. Adjust rate of application to eliminate puddles. Any white residue must be removed immediately.
   5. Allow treated surfaces to dry.
   6. Remove any dried powder residue using a stiff broom, power sweeper, or auto-scrubbing machine.
   7. Dry-Buff or burnish concrete surface in both directions with orbital floor machine or burnisher equipped with appropriate polishing pad for additional surface sheen.

3.04 PROTECTION

A. Protection: General Contractor shall protect areas to receive sealed concrete finish at all times during construction to prevent oils, dirt, metal, excessive water and other potentially damaging materials from affecting the finished concrete surface. Protection measures listed below shall begin immediately after the concrete slab is poured.

B. Plywood slab protection in traffic corridors, entry ways, and areas to receive sealer shall be provided by and maintained by General Contractor throughout construction until the finishing contractor takes ownership of the floor. Protection shall be sufficient to protect surface from damage due to traffic and impact from any and all construction activities with a minimum of 1/2" plywood. All seams of plywood shall be sealed to eliminate passage of debris to new floor.

C. Protect slab during masonry work and after completion of sealed concrete finish work with minimum of 1/2-inch plyboard, with sealed seams.

D. Do not allow any trade to park any vehicles on the inside slab. If necessary to complete their scope of work, drop cloths will be placed under vehicles at all times.

E. Diaper all hydraulic powered equipment to avoid staining of the concrete.

F. Place no steel on interior slab to avoid rust stains and gouges. If construction dictates necessity of this, interior slab will be protected with 1/2-inch plyboard.

G. Do not allow acids and acidic detergents to come into contact with slab.

H. Inform all trades that the slab must be protected at all times.

I. Protect finished work until fully cured in accordance with manufacturer's recommendations.

J. Protect completed floor from damage until Substantial Completion.
   1. Do not allow vehicle and pedestrian traffic on unprotected floor.
   2. Do not allow construction materials, equipment, and tools on unprotected floor.

K. Immediately remove mortar splatter, spilled liquids, oil, grease, paint, coatings, and other surface contaminants which could adversely affect completed floor.

L. Repair damaged areas of completed floor to satisfaction of Architect.

M. Protect floor from traffic for at least 72 hours after final application of sealer.

N. Upon completion of sealer, the General Contractor and the finishing subcontractor shall replace the plywood protection for the duration of the project.

3.05 MAINTENANCE

A. Sealed floors should be maintained by sweeping. Spills should be cleaned when they occur and dirt shall be rinsed off with water. Heavily soiled areas may be wet-cleaned by mopping or by scrubbing with a rotary floor machine equipped with a scrubbing brush and a suitable, high quality commercial detergent. Interior floors that require polishing should be maintained using a compatible, premium-grade, emulsion-type, commercial floor polish, following manufacturer's instructions and safety requirements.

END OF SECTION

SECTION 04 2000
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.
B. Clay facing brick.
C. Face brick.
D. Mortar and grout.
E. Reinforcement and anchorage.
F. Flashings.
G. Accessories.
H. Water Repellents.

1.02 RELATED REQUIREMENTS

A. Section 01 2100 - Allowances: Masonry Mortar Coloring, and Face Brick Allowance.
B. Section 01 4000 - Quality Requirements: Requirements for mock-ups.
C. Section 03 3931 - Curing, Sealing and Hardening Concrete Floors: Protection of concrete slab during masonry work.
D. Section 04 7200 - Cast Stone Masonry.
E. Section 05 5000 - Metal Fabrications: Loose steel lintels.
F. Section 07 8400 - Firestopping: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.
G. Section 07 9005 - Joint Sealers: Backing rod and sealant at control and expansion joints.
H. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2100 - Allowances, for cash allowances affecting this section.
B. This allowance includes purchase and delivery of face brick and mortar color. Installation is not included in the allowance but is specified in this section and is part of the Contract Sum/Price.

1.04 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2026.
C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019 (Reapproved 2025).
D. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.
F. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2022.
G. ASTM C90 - Standard Specification for Dry-Cast Loadbearing Concrete Masonry Units; 2024a.
H. ASTM C91/C91M - Standard Specification for Masonry Cement; 2025.

I. ASTM C129 - Standard Specification for Dry-Cast Nonloadbearing Concrete Masonry Units; 2025.

J. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2026.

K. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2025.

L. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.

M. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2024.

N. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2024.

O. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2025b.

P. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2024.

Q. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

R. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2025a.

S. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength; 2022.

T. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2024.

U. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2025.

V. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2020.

W. BIA Technical Notes No. 28B - Brick Veneer/Cold-Formed Steel Framed Walls; 2025.

X. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.

Y. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.

Z. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.

AA. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

BB. UL (FRD) - Fire Resistance Directory; Current Edition.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, masonry accessories, and water repellant and other manufactured products indicated, including certifications that each item and type complies with specified requirements. Also, submit product data for flashings and accessories..

C. Samples: Flashings: Submit two 4 x 4 inch samples of masonry flashings.

D. Shop drawings for reinforcing, if any, detailing fabrication, bending, and placement of unit masonry reinforcing bars. Comply with ACI 315(Details and Detailing of Concrete Reinforcing), showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement.

E. Coordination Drawing indicating the locations of proposed CMU control joints.

F. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

G. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Facing Brick units: 500 of each type, size and color combination.

1.07 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Fire Rated Assemblies: Conform to applicable code for fire performance requirements for fire rated masonry construction. Where indicated, provide materials and construction identical to those of assemblies whose fire resistance has been determined per ASTM E 119 by a testing and inspecting organization, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

C. Single Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

D. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

E. Single-Source Responsibility for Water Repellents: Obtain each type of integral water repellents from a single manufacturer for the entire project.
   1. Verify full compatibility with any other coatings, fluid applied waterproofing, etc., prior to application of this and other products. Notify Architect in writing and in detail, of any incompatible products, prior to any application, and await Architect's written direction on how to proceed.

F. Single-Source Responsibility for Through-Wall Flashings: Self-adhering membrane flashings associated with through-wall flashings in this Section shall be manufactured by the manufacturer of the water/air barrier coating specified in Section 07 1400 - Fluid Applied Air Barrier, for material compatibility and single-source manufacturing responsibility.

1.08 MOCK-UPS

A. Include Unit Masonry in mock-up as described in Section 01 4000 - Quality Requirements.

B. Construct a representative wall sample, 6 feet wide by 10 feet high, which includes face brick, mortar and accessories, architectural masonry veneer, cast stone, metal-framed storefronts, with masonry back-up and metal stud and sheathing backup where applicable; with accompanying flashing, sealants, and waterproofing (air barrier). Also, eave condition, including soffit and gutter is included. This panel will be for the purpose of approving the wall system, and its components.

C. Construct two additional separate masonry walls as a mock-up panel sized 4 feet long by 4 feet high, including one (1) vertical control joint, which include mortar and accessories, for the purpose of approving colors and finish.

D. Build mock-ups to comply with the following requirements, using materials indicated for final unit of Work.
   1. Locate where directed.
   2. Coordinate with work of other Sections.
   3. Mock-up may not remain as part of the Work.
   4. Protect mock-ups from the elements with weather-resistant membrane.
   5. Retain and maintain mock-ups during construction in undisturbed condition as standard for judging completed unit masonry construction.

6. When directed, demolish and remove mock-ups from Project site.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Store cementitious materials and insulation off the ground, under cover, and in dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.

E. Store water repellents in strict accordance with manufacturer's written recommendations, off of ground, under cover, and otherwise as required to protect from damage, contamination, etc.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530.1/ASCE 6/TMS 602 or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depths as indicated on drawings for specific locations. Furnish 8 inch deep units if depth is not indicated on the drawings.
   2. Special Shapes: Provide non-standard blocks configured for corners, lintels, headers, control joint edges, bonding, and other detailed conditions.
      a. Outside Corner Units: Provide square edged units for outside corners unless otherwise indicated.
      b. Provide one quarter notched foundation block and other preformed shapes, if any, as indicated on the drawings.
   3. Load-Bearing Units: ASTM C90, normal weight.
      a. Hollow block, as indicated.
      b. Unit Compressive Strength: Provide units with minimum average net area compressive strength of 1,900 psi.
      c. Weight Classification at Above Grade Locations: Lightweight, except provide Normal Weight units where required to achieve required fire-ratings according to manufacturer's testing and/or by "calculated fire resistance" as may be allowed by applicable building code.
      d. Exposed Faces: Manufacturer's standard color and texture where indicated.
   4. Nonloadbearing Units: ASTM C129.
      a. Hollow block, as indicated.
      b. Lightweight.
      c. Unit Compressive Strength: Provide units with minimum average net area compressive strength of 1,900 psi.
   5. Units with Integral Water Repellent: Concrete block units as specified in this section with polymeric liquid admixture added to concrete masonry units at time of manufacture.
      a. Performance of Units with Integral Water Repellent:
         1) Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours.
            (a) No water visible on back of wall above flashing at the end of 24 hours.
            (b) No flow of water from flashing equal to or greater than 0.032 gallons per hour (0.05 L per hour) at the end of 24 hours.
            (c) No more than 25 percent of wall area above flashing visibly damp at end of test.

2) Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
3) Compressive Strength: ASTM C1314; maximum 5 percent decrease.

b. Use only in combination with mortar that also has integral water repellent admixture.
c. Use water repellent admixtures for masonry units and mortar by a single manufacturer.

2.02 BRICK UNITS

A. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
1. Color and texture: To be selected by Architect after bidding, from products complying with allowance amounts in Section 01 2100 - Allowances.
2. Size: Brick size to be modular, unless noted otherwise.
3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
4. For sills, caps and similar applications resulting in exposure to brick surfaces which otherwise would be concealed from view, provide uncored or unfrogged units with all exposed surfaces by sawing.

2.03 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91.
1. Colored Mortar: Premixed cement as required to match Architect's color sample.
2. Colored mortar: To be selected by Architect after bid date for all locations indicated on the Drawings, within Allowance amount in Section 01 2100 - Allowances. Color to be selected from manufacturers standard formulations of at least 15 selections, unless indicated otherwise.

B. Portland Cement: ASTM C150/C150M, Type I or II; color as required to produce approved color sample.
1. Not more than 0.60 percent alkali.

C. Hydrated Lime: ASTM C207, Type S.

D. Mortar Aggregate: ASTM C144.

E. Grout Aggregate: ASTM C404.

F. Water: Clean and potable.

G. Accelerating Admixture: Nonchloride type for use in cold weather.

H. Water Repellent and Efflorescence Control Mortar Admixture, approved by mortar manufacturer: Water repellent and efflorescence-control mortar admixture demonstrating resistance to moisture migration and wind-driven rain per ASTM E 514.
1. Acceptable product: "MasterPel 240MA" as manufactured by Master Builders Solutions, of BASF Corporation.
a. Substitutions: See Section 01 6000 - Product Requirements.
2. Extent of water repellent admixture: For use in face brick mortar. (Not for CMU mortar.)

2.04 REINFORCEMENT AND ANCHORAGE

A. Manufacturers:
1. Dur-O-Wal: www.dur-o-wal.com.
2. Hohmann & Barnard, Inc: www.h-b.com/#sle.
3. Sandell and Diedrich: www:sandellmfg.com.
4. WIRE-BONDwww.wirebond.com/#sle.

B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa), deformed billet bars; uncoated.

C. Single Wythe Joint Reinforcement: Truss or ladder type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage on each exposure.

D. Adjustable Multiple Wythe Joint Reinforcement: Truss type with adjustable ties or tabs spaced at 16 in (406 mm) on center and fabricated with moisture drip; ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/153M, Class B; 0.1875 inch (4.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods and adjustable components of 0.1875 inch (4.8 mm) wire; width of components as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage from each masonry face.
   1. Vertical adjustment: Not less than 2 inches (50 mm).

E. Concrete frame: Dovetail anchors of bent steel strap, nominal 1 inch (25 mm) width x 0.024 in (0.61 mm) thick, with trapezoidal wire ties 0.1875 inch (4.75 mm) thick, hot dip galvanized to ASTM A 153/A 153M, Class B.

F. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch (6.3 mm) thick, with trapezoidal wire ties 0.1875 inch (4.75 mm) thick, hot dip galvanized to ASTM A 153/A 153M, Class B.

G. Steel frame (For anchoring cast stone to frame): Sheet metal plate, 3/4 inch x 6 inch long for welding to frame, 0.105 mm thick equal to H-B 359-FH, with trapezoidal wire ties 0.1875 inch (4.75 mm) thick, hot dip galvanized to ASTM A 153/A 153M, Class B.

H. Masonry Veneer Anchors: 2 piece adjustable veneer anchor for cavity wall construction, to accommodate board insulation. Hot dip galvanized. Consists of L-shaped plate with holes for connecting screws and pintle insertion. Equal to HB-213 for metal stud construction, and HB-5213 for concrete, CMU or brick backup.

I. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
   1. Anchor plates: Not less than 0.075 inch (1.91 mm) thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
   2. Wire ties: Manufacturer's standard shape, 0.1875 inch (4.75 mm) thick.
   3. Vertical adjustment: Not less than 3-1/2 inches (89 mm).

J. Anchor Bolts: Steel bolts complying with A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations, as indicated on the Drawings, or if not indicated, as required for the intended use:
   1. Headed bolts.
   2. Nonheaded bolts, straight.
   3. Nonheaded bolts, bent in manner indicated.

2.05 FLASHINGS

A. Self-adhered, rubberized asphalt/polyethylene flashing membrane for cavity wall applications.
   1. Self-adhesive cold applied membrane consisting of 0.8 mm(32 mils) of rubberized asphalt integrally bonded to a 0.2 mm (8mil) high density, cross laminated polyethylene film.
      a. Thickness: 1mm (40 mils).
      b. Rolls should be inter-wound with disposable silicone-coated release sheet.
      c. Provide required companion surface conditioner product, and all other materials and components recommended by flashing manufacturer.
   2. Product/Manufacturer:
      a. "CCW-705-TWF"; Carlisle Coatings & Waterproofing, Inc.: www.carlisle-ccw.com.
      b. "Polyguard 400 Thru Wall Flashing"; Polyguard Products, Inc.: www.polyguardproducts.com.
      c. "Perm-A-Barrier Wall Flashing"; W.R. Grace & Co.-Conn., Atlanta, GA: www.na.graceconstruction.com.
      d. "Textroflash Flashing"; Hohmann & Barnard, Inc.
   3. Application: Use at stud backup locations where flashing is fully concealed in masonry, including in part, wall flashing, below sills, at lintels and heads of openings, above grade weeps at base of exterior walls, etc.

a. Termination of membrane at dampproofed backup wall must occur 8" above mortar drainage medium, or approximately 16" above shelf angle. Termination shall be accomplished using termination bar specified below.
1) Termination bar shall be encapsulated with sealant compatible with water/air barrier coating. Acrylic latex sealant shall not be used.

B. Stainless Steel Flashing: Type 304, soft temper; 24 gauge, 0.0250 inches thick for through-wall applications; 26 gauge otherwise; finish 2B to 2D. Comply with ASTM A 666.
1. Shop-fabricated Metal Flashing (typical below parapet caps and all other tops of walls exposed at the exterior of building and other locations on site), covered with self-adhering flashing to make watertight.
2. Low-profile concealed through-wall sheet metal flashing, fabricated with ribs at 3-inch intervals along length of material, to provide an integral bond with solid mortar bedding at each side.
3. Height: 3/8-inch.
4. Width: 1-inch less than wall thickness (set in-place 1/2-inch back from each exterior wall face).
5. Product: Shop-fabricated stainless steel, fabricated to specific project requirements. Cover with self-adhered, rubberized asphalt flashing for cavity wall application.
6. Location: Masonry cavity flashing at relief angles and as noted.
a. Waterproofing membrane shall terminate onto stainless steel pan. Termination shall be a minimum of 1" back from face of exterior masonry wall.
b. Stainless steel flashing shall be end-dammed at termination between through-wall flashing and dissimilar systems.
c. Provide minimum 2" tall back dams, and minimum 2" tall end dams.

2.06 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
1. Manufacturers:
a. Dur-O-Wal: www.dur-o-wal.com.
b. Hohmann & Barnard, Inc: www.h-b.com/#sle.
c. WIRE-BOND: www.wirebond.com/#sle.

B. Joint Filler: Closed cell rubber; oversized 50 percent to joint width; self expanding; in maximum lengths available.
1. Manufacturers:
a. Dur-O-Wal: www.dur-o-wal.com.
b. Hohmann & Barnard, Inc: www.h-b.com/#sle.
c. Sandell and Diedrich: www:sandellmfg.com.
d. WIRE-BOND: www.wirebond.com/#sle.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage. 18" high.
1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
a. Manufacturers:
1) Advanced Building Products Inc; Mortar Break II: www.advancedflashing.com/#sle.
2) CavClear/ Archovations, Inc.; "Masonry Mat": www.cavclear.com.
3) Mortar Net Solutions; MortarNet: www.mortarnet.com/#sle.
4) "Polyguard Mortar Deflector"; Polyguard Products, Inc.: www.polyguardproducts.com.
5) Sandell Construction Solutions; "Mortar Web": www.sandellmfg.com.
6) Substitutions: See Section 01 6000 - Product Requirements.

b. Location: At the bottom of all masonry drainage cavities, where indicated, and wherever the masonry drainage cavity is interrupted by relief angles, windows, door, or other interruptions. Also provide full height at masonry to flashing conditions at window and door jambs, as indicated.

D. Building Paper: ASTM D226/D226M, Type I ("No.15") asphalt felt.

E. Termination Bar: Stainless steel bar designed to terminate and seal top of flashing in cavity wall. Bar shall be flat and shall have pre-drilled holes 8" o.c. for attachment to substrate with appropriate non-corrosive fasteners. Bar shall be 3/4" wide by 1/8" thick.
1. Termination bar shall be encapsulated with compatible sealant. Note: The sealant shall be compatible with the water/air barrier coating, and shall be compatible with the waterproofing membrane and adhesives. (Acrylic latex sealant shall NOT be used.)

F. Weeps: ectangular plastic with cotton rope and screens.
1. Color(s): As indicated on drawings.
2. Manufacturers:
a. CavClear, a Division of Archovations Inc; _____: www.cavclear.com/#sle.
b. Mortar Net Solutions: www.mortarnet.com/#sle.
c. Sandell and Diedrich: www:sandellmfg.com.
d. Substitutions: See Section 01 6000 - Product Requirements.

G. Cavity Vents:
1. Type: Molded PVC grilles, insect resistant.
2. Color(s): As selected by Architect from manufacturer's full range.
3. Extent: At top course of masonry, at each end of precast header, and as noted.
4. Manufacturers:
a. CavClear, a Division of Archovations Inc; _____: www.cavclear.com/#sle.
b. Hohmann & Barnard, Inc; _____: www.h-b.com/#sle.
c. Mortar Net Solutions: www.mortarnet.com/#sle.
d. Sandell and Diedrich: www:sandellmfg.com.

H. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.07 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
1. Masonry below grade and in contact with earth: Type M.
2. Exterior, loadbearing masonry: Type S.
3. Exterior, non-loadbearing masonry: Type N.
4. Interior, loadbearing masonry: Type S.
5. Interior, non-loadbearing masonry: Type N.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).

D. Mixing: Use mechanical batch mixer and comply with referenced standards.

2.08 WATER REPELLENT

A. Provide from a company with minimum five years experience manufacturing water repellent, and by an applicator with minimum five years experience applying water repellent. Post-applied water repellent product shall be equivalent to “Siloxane PD” as manufactured by SureKlean Weather Seal, subsidiary of Prosoco: www.prosoco.com. One Coat, unless otherwise required by Architect, or recommended by Manufacturer.
1. Other Manufacturers/Products:
a. BASF; "Hydrozo 100": www.BuildingSystems.BASF.com.
b. Diedrich Technologies; "303S Siloxseal": www.diedrichtechnologies.com.

c. Substitutions: See Section 01 6000 - Product Requirements.
2. Submit for approval prior to application.
3. Include in Mock-Up walls for approval.
4. Application rate not to exceed product manufacturer's current written recommendations, but 100% coverage is required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of unit masonry, if any.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

D. Do not proceed until all unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

C. Mason is to coordinate with electrical, mechanical, plumbing, and any other trade that will have in-wall work, prior to starting of masonry work.

D. Where adjacent flooring is to receive concrete sealing or staining, or polishing and dyeing, provide minimum 1/2" plywood protection over floor, as described in Section 03 3543 –Concrete Polishing and Dyeing, or Section 03 3931 - Curing, Sealing, and Hardening Concrete Floors.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
1. Mix units from several pallets or cubes as they are placed.

3.05 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement type joints, returns, and offsets. Avoid the use of less than half size units at corners, jambs, and where possible at other locations.

D. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2-inches. Bond and interlock each course of each wythe at corners.

E. Stopping and Resuming Work: In each course, rack back 1/2 unit length in each course; do not tooth. Clean exposed surfaces of set masonry, wet masonry units lightly (if required), and remove loose masonry units and mortar prior to laying fresh masonry.

F. Built-In Work:
   1. As construction progresses, build-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.
   2. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
   3. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

G. Fill cores in hollow concrete masonry units with grout 3 courses (24-inches) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

H. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
   3. Mortar Joints: Concave.

I. Brick Units:
   1. Bond: Running.
   2. Coursing: Three units and three mortar joints to equal 8 inches (200 mm).
   3. Mortar Joints: Concave.

3.06 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses; both outside and inside the cavity.

E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

F. Interlock intersections and external corners. Do not use units with less than nominal 4 inch horizontal face dimensions at corners or jambs.

G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

I. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

J. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

K. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.07 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches (600 mm) on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

B. Install cavity vents in veneer and cavity walls at 32 inches (800 mm) on center horizontally below shelf angles and lintels and near top of walls.

3.08 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
   1. Contractor is to keep cavity clean of mortar droppings and not allow for excessive mortar into the cavity.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.09 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide concrete unit masonry that develops the following installed compressive strengths (f'm): f'm = 1,500 psi.

3.10 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches (150 mm).

E. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches (400 mm) on center.

F. Embed tie section in masonry joints. Provide not less than 1 inch air space between back of masonry veneer wythe and face of sheathing.

3.11 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

A. Install horizontal joint reinforcement 16 inches (400 mm) on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches (150 mm).

E. Reinforce joint corners and intersections with strap anchors 16 inches (400 mm) on center.

3.12 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches (400 mm) on center vertically and 32 inches (800 mm) on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.

B. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches (400 mm) on center vertically and 16 inches (400 mm) on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.

3.13 REINFORCEMENT AND ANCHORAGES - CAVITY WALL MASONRY

A. Install horizontal joint reinforcement 16 inches (400 mm) on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of openings.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches (150 mm).

E. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Space anchors at maximum of 24 inches (600 mm) horizontally and 16 inches (400 mm) vertically.

F. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches (400 mm) on center.

3.14 MASONRY FLASHINGS

A. Install flashings in accordance with Drawings, approved shop drawings, and manufacturer's recommended installation instructions.

B. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches (152 mm), minimum, into adjacent masonry or turn up flashing ends at least 8 inches (203 mm), minimum, to form watertight pan at non-masonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing with approved mastic or approved equivalent before covering with mortar.

C. Prepare masonry surfaces so that they are smooth and free from projections that could puncture flashing. Place flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with adhesive/sealant/tape, as recommended by flashing manufacturer before covering with mortar.
   1. Where indicated or required by manufacturer, provide continuous seal at top edge, using their recommended materials.

D. Cover all flashing splices with a third piece of flashing, fully bedded in medium modulus silicone such as Dow 795, Tremco Spectrem 2, Pecora 895, or approved equal.

E. Extend metal flashings through exterior face of masonry and turn down to form drip. Install joint sealer below drip edge to prevent moisture migration under flashing.

F. Extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 8 inches on back-up wall (at stud walls), and seal top edge with termination bar and sealant; except turned up a minimum of 8 inches at back-up masonry walls and extended through back-up wall to within 1/2-inch of its interior face.

G. At heads and sills, extend flashing as specified above unless otherwise indicated, but turn up ends not less than 2 inches to form a pan.

H. Lap end joints of flashings at least 6 inches (152 mm), minimum, and seal watertight with flashing sealant/adhesive.

I. Install stainless steel metal drip edge when using flexible flashing.

J. Prior to starting the installation of flashing, an in-place mock-up will be required.

K. Coordinate step flashing with roof installer.

3.15 LINTELS

A. Install galvanized loose steel lintels over openings.

B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
   1. Openings to 42 inches (1070 mm): Place two, No. 3 (M9) reinforcing bars 1 inch (25 mm) from bottom web.
   2. Openings from 42 inches (1070 mm) to 78 inches (1980 mm): Place two, No. 5 (M16) reinforcing bars 1 inch (25 mm) from bottom web.
   3. Openings over 78 inches (1980 mm): Reinforce openings as detailed.
   4. Do not splice reinforcing bars.
   5. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
   6. Place and consolidate grout fill without displacing reinforcing.
   7. Allow masonry lintels to attain specified strength before removing temporary supports.

C. Maintain minimum 8 inch (200 mm) bearing on each side of opening.

3.16 GROUTED COMPONENTS

A. Lap splices minimum 24 bar diameters.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.

C. Place and consolidate grout fill without displacing reinforcing.

D. At bearing locations, fill masonry cores with grout for a minimum 12 inches (300 mm) either side of opening.

3.17 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints. Install control and expansion joints in unit masonry where existing in floor slabs, walls, and roof, and as otherwise indicated. Build in related items as the masonry progresses.

B. Horizontal bond beams and reinforcing shall continue through vertical masonry control joints.

C. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant. Use firestop materials at fire-rated walls, as specified.

D. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

E. Provide control joints at locations indicated or as approved by Architect, and not to exceed the following at continuous straight runs:
   1. Exterior and Interior Walls: 25'-0" o.c. maximum along continuous runs of brick masonry.
   2. Walls of concrete masonry units: 25'-0" o.c. maximum along continuous runs of CMU, unless indicated otherwise.
   3. Also provide control joints at inside corners, and within 2'-0" of outside corners.

F. Size control joint in accordance with Section 07 9005 for sealant performance.
   1. Joint width: 3/8" up to 16' spacing; 1/2" for 16'-22' spacing, and 5/8" for 22'-30' spacing.
   2. Joints shall be clear of mortar. Seal with silicone sealant, with optional compressible joint filler.

3.18 WATER REPELLENTS

A. Apply water repellents to all exterior masonry, unless scheduled to receive a coating under another division, after thorough cleaning and rinsing, prior to any backfill or any other concealment.

B. Install in strict accordance with manufacturer's current written instructions and recommendations. Test for application rate.

C. Thoroughly clean and rinse all masonry prior to application of water repellents, water-proofing, coatings, paint, etc. Comply with written recommendations of each manufacturer of products to be applied to masonry work.

3.19 BUILT-IN WORK

A. As work progresses, install built-in metal door frames, glazed frames, fabricated metal frames, window frames, anchor bolts, and plates and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
   1. Fill adjacent masonry cores with grout minimum 12 inches (300 mm) from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.20 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.

C. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).

E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).

F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

G. Maximum Variation for Vertical Alignment of Head Joints: 1/4 inch in 10 ft, 1/2" maximum.

3.21 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.22 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.

C. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

D. Use Volume Boxes.

3.23 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.
   1. Clean glass unit masonry as work progresses. Remove mortar fins and smears immediately, using a clean, wet sponge or a scrub brush with still fiber bristles. Do not use harsh cleaners, acids, abrasives, steel wool, or wire brushes when removing mortar or cleaning glass unit masonry.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings, and adjacent construction to provide a neat, uniform appearance, prepared for application of sealants.

C. Remove all efflorescence from concrete masonry units, exposed and not exposed. Ensure that all masonry walls are dry prior to installation of air and water barriers or other finish materials.

D. Remove excess mortar and mortar droppings. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.

E. Replace defective mortar. Match adjacent work.

F. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Saturate wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean brick by means of bucket and brush hand-cleaning method described in BIA "Technical Note No. 20 Revised", to clean brick masonry made of clay or shale, except use detergent as the masonry cleaner.
6. Clean concrete masonry by means of cleaning method indicated in NCMA TEK 45 applicable to type of stain present on exposed surfaces.
7. Comply with masonry manufacturer's instructions.

3.24 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

B. Protection of Masonry:
   1. During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   2. Extend cover a minimum of 24-inches down both sides and hold cover securely in place.
   3. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24-inches down face next to unconstructed wythe and hold cover in place.

C. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

D. Stain Prevention:
   1. Prevent grout, mortar, and soil from staining the face of masonry to be left exposed, painted, and/or to receive any other coatings. Remove immediately any grout, mortar, and soil that come in contact with such masonry.
   2. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface, until landscaping or other improvements indicated adjacent to completed masonry work are in place.
   3. Protect sills, ledges, and projections from mortar droppings.
   4. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes from mortar droppings, coatings, water repellents, and/or any other damage.

END OF SECTION

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SECTION 04 7200
CAST STONE MASONRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Architectural Cast Stone.

B. Units Required are running bond walls, sills, banding, and other custom shapes as indicated.

C. Architectural Precast Concrete.

D. Water Repellents.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of Contract, including General Conditions and Division 1 Specification Sections, apply to the work of this Section.

B. Section 04 2000 - Unit Masonry: Installation of cast stone in conjunction with masonry.

C. Section 07 6200 - Sheet Metal Flashing and Trim: Flashing, Vents and Masonry Accessories.

D. Section 07 9005 - Joint Sealers: Materials and execution methods for sealing soft joints in cast stone work.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2026.

C. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2024.

D. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2022.

E. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.

F. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.

G. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2025b.

H. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2024.

I. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2024.

J. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2025.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.

C. Product Data: Test results of cast stone components made previously by the manufacturer.
   1. Include one copy of ASTM C1364 for Architect's use.

D. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.
   1. Anchoring design shop drawings shall include design engineer's stamp or seal and signature on each sheet, certifying attachment details, anchorage, and size and shape of fasteners are in conformance with all State and local codes and regulations.

E. Mortar Color Selection Samples.

F. Samples, For Review:

1. Basic Shapes: One of each, not less than 8 inches long. For selection of color, texture and shape.
2. Accent, Trim and Specialty Shapes: One of each.

G. Verification Samples: Pieces of actual cast stone components not less than 8 inches (___ mm) long, illustrating range of color and texture to be anticipated in components furnished for the project.

H. Full-Size Samples: One unit of each shape, for review. Make available for Architect's review at Project site.

I. Mortar Color Verification Samples.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. A firm with a minimum of 5 years experience producing cast stone of types required for project.
2. Current producer member of the Cast Stone Institute or the Architectural Precast Association with a minimum of 10 years experience in producing cast stone of the types required for the project.
3. Manufacturer's production facility currently holds a Plant Certification from the Cast Stone Institute or the Architectural Precast Association.
4. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.
5. Manufacturer shall have an internal Quality Assurance Testing Program with Certified Laboratory Technician.
6. Obtain cast stone units through one source from a single manufacturer.

B. Professional Engineer Qualifications: Professional engineer experienced in design of this work and licensed in the state in which the project is located, or personnel under direct supervision of such an engineer.

C. Single-Source Responsibility: Obtain cast stone units and architectural precast products from a single manufacturer. The purpose of this is to guarantee that color and texture of such products is the same.

D. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

E. Single-Source Responsibility for Water Repellents: Obtain each type of integral and applied water repellents from a single manufacturer for the entire project.
1. Verify full compatibility with any other coatings, fluid applied waterproofing, etc., prior to application of this and other products. Notify Architect in writing and in detail, of any incompatible products, prior to any application, and await Architect's written direction on how to proceed.

1.06 MOCK-UP

A. Include cast stone masonry in Mock-Up as described in Section 01 4000 - Quality Requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Schedule and coordinate production and delivery of architectural cast stone products with unit masonry work.

B. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.
1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining.
2. Provide itemized shipping list.

C. Number each piece individually to match shop drawings and schedule.

D. Store cast stone components and installation materials in accordance with manufacturer's instructions.

E. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt and splashing.

F. Protect cast stone components, including corners and edges, during storage, handling and installation to prevent chipping, cracking, staining, or other damage.

G. Handle long units at center and both ends simultaneously to prevent cracking.

H. Do not use pry bars or other equipment in a manner that could damage units.

I. Store mortar materials where contamination can be avoided.

J. Stained or damaged units will not be accepted and will be replaced at the Contractor's expense.

K. Schedule and coordinate production and delivery of architectural cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

2.02 ARCHITECTURAL CAST STONE

A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural limestone, complying with ASTM C1364.
   1. Casting Method: Vibrant dry hand tamp or wet cast as required.
   2. Compressive Strength: ASTM C 1194: Minimum 6,500 psi at 28 days.
   3. Absorption, ASTM C 1195: Maximum 6 percent, by cold water method, at 28 days.
   4. Linear Shrinkage, ASTM C 426: Less than 0.065 percent.
   5. Density, ASTM C 140: Greater than 120 pounds per cubic foot.
   6. Freeze-Thaw, ASTM C 666: Less than 5 percent cumulative mass loss after 300 cycles.
   7. Air Content: ASTM C 173 or C 231 for wet cast product shall be 4-8 percent for units exposed to freeze-thaw environments; air entrainment is not required for VDT products.
   8. Remove cement film from exposed surfaces before packaging for shipment.

B. Shapes: Provide shapes indicated on drawings.
   1. Variation from any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch (3 mm) or length divided by 360, whichever is greater, but not more than 1/4 inch (6 mm).
   2. Unless otherwise indicated on drawings, provide:
      a. Wash or slope of 1:12 on exterior horizontal surfaces.
      b. Drips on projecting components, wherever possible.
      c. Raised fillets at back of sills and at ends to be built in.
   3. Bed Depth: 3-5/8 inches, unless indicated otherwise.

C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI CODE-318.
   1. Pieces More than 24 inches (610 mm) in Any Dimension: Provide full length two-way reinforcement of cross-sectional area not less than 0.25 percent of unit cross-sectional area.

2.03 MATERIALS

A. Portland Cement: ASTM C150/C150M.
   1. For Units: Type I, white or gray as required to match Architect 's sample.
   2. For Mortar: Type I or II, except Type III may be used in cold weather.

B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.

C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.

D. Pigments: ASTM C979, inorganic iron oxides; do not use carbon black.

E. Admixtures: ASTM C494/C494M.
   1. Water Reducing, Retarding, and Accelerating Admixtures: ASTM C 494.
   2. ASTM C 260 for air-entraining admixtures.
   3. Integral Water Repellant, approved by cast stone manufacturer: Integral water repellent and efflorescence control admixture demonstrating resistance to wind-driven rain per ASTM E 514:
      a. Acceptable product: "Rheopel Plus" Water Repellent and Efflorescence Control Admixture, as manufactured by Master Builders, of BASF Construction Chemicals, LLC.
   4. ASTM C 618 for mineral admixtures.
   5. ASTM D 989 for ground granulated blast-furnace slag.
   6. Other Admixtures For which no ASTM standard exists, shall be previously established as suitable for use in concrete by proven field performance or through laboratory testing.

F. Water: Potable.

G. Reinforcing Bars: ASTM A615/A615M deformed bars, epoxy coated or galvanized when covered with less than 1-1/2 inches of material.
   1. Galvanized in accordance with ASTM A767/A767M, Class I.
   2. Epoxy coated in accordance with ASTM A775/A775M.

H. Steel Welded Wire Reinforcement: ASTM A 185/A 185M, galvanized or epoxy coated.

I. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions. Cast stone supplier is responsible for supplying all necessary anchors.

J. Shelf Angles and Similar Structural Items: Hot-dip galvanized steel per ASTM A123/A123M, of shapes and sizes as required for conditions.

K. Mortar: Portland cement-lime, ASTM C270 Type N ; do not use masonry cement.

L. Sealant, and backer rods: As specified in Section 07 9005.

M. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

2.04 ACCESSORIES

A. Bond Breaker: 6-mil polyethylene.

B. Water Repellent: Product with UV sensitive/fugitive dye, in water carrier; or equal product, approved by cast stone manufacturer. Water repellent manufacturer shall provide certification that water repellent is compatible with cast stone and other (integral) water repellents used. Application: One coat, unless otherwise required to obtain complete coverage.
   1. Application rate not to exceed product manufacturer's current written recommendations, but 100% coverage is required.
   2. Submit for approval prior to application.

C. Cavity Vents: Plastic tubes with brass or stainless steel screens. Spaced 3'-4" o.c., unless noted otherwise.
   1. Manufacturers:
      a. Advanced Building Products, Inc. "Mortar Maze Weep Tubes"; www.advancedflashing.com.
      b. Hohmann & Barnard, Inc; "341S": www.h-b.com/sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

D. Weeps: Plastic tubes with cotton rope and brass or stainless steel screens. Spaced 2' o.c., unless noted otherwise.
   1. Manufacturers:
      a. Advanced Building Products, Inc. "Mortar Maze Weep Tubes"; www.advancedflashing.com.

b. Hohmann & Barnard, Inc; "341W/S": www.h-b.com/sle.
c. Substitutions: See Section 01 6000 - Product Requirements.

2.05 TOLERANCES

A. General: Manufacture cast stone units within tolerances in accordance with Cast Stone Institute Technical Manual, unless otherwise specified.

B. Cross Section Dimensions: Do not deviate by more than plus or minus 1/8 inch from approved dimensions.

C. Length of Units: Do not deviate by more than length/360 or plus or minus 1/8 inch, whichever is greater, not to exceed plus or minus 1/4 inch.

D. Warp, Bow, or Twist: Do not exceed length/360 or plus or minus 1/8 inch, whichever is greater.

2.06 FINISHES

A. General: Smooth. Match texture and color of full-size sample on file with Architect.

B. Texture of surfaces exposed to view:
1. Fine-grained texture similar to natural stone.
2. Approximately equal to approved sample when viewed in direct daylight at 10 feet.

C. Surface Air Voids:
1. Size: Maximum 1/32 inch.
2. Density: Less than 3 occurrences per any 1 square inch.
3. Viewing Conditions: Not obvious under direct daylight at 10 feet.

D. Color:
1. Match Architect's sample.
2. Color Variation:
a. Viewing Conditions: Compare in direct daylight at 10 feet, between units of similar age, subjected to similar weathering conditions.
b. Total Color Difference: ASTM C 1364, 6 units.
c. Hue Difference: ASTM C 1364, 2 units.

E. Chipping:
1. Minor chipping: Chips which are not obvious in direct daylight at 20 feet.
2. Chipping which exceeds definition of minor chipping, as determined by Architect, shall be grounds for rejection of units.

2.07 SOURCE QUALITY CONTROL

A. Plant Production Testing: Test compressive strength and absorption from specimens selected at random from plant production. Tests to be conducted by certified laboratory testing technicians.
1. Custom Cast Stone Units: Test in accordance with ASTM C 1194 and C 1195.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.

B. Do not begin installation until unacceptable conditions have been corrected.

C. Examine cast stone units before installation. Do not install unacceptable units.

3.02 INSTALLATION

A. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 2000.
1. Use masonry wall ties specified in Section 04 2000 - Unit Masonry.
2. Pull units from multiple cubes during installation to minimize variation in color and help with natural blending.

3. Cut units using motor-driven masonry saws. Turn finished ends to the visible side and turn the saw cut to the inside of the mortar joints to hide exposed aggregates and saw marks.
4. Avoid use of pry bars or other equipment in a manner that could damage units.

B. Setting:
1. Set units in a full bed of mortar unless otherwise indicated.
2. Fill vertical joints with mortar.
3. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.03 REPAIR

A. Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet (6 m).

B. Repair with matching touch-up material provided by the manufacturer and in accordance with manufacturer's instructions.

C. Repair methods and results to be approved by Architect.

D. Units that cannot be repaired satisfactorily shall be replaced.

3.04 CLEANING

A. Clean completed exposed cast stone after mortar is thoroughly set and cured.

B. Perform test of cleaner on small area of 4 feet by 4 feet on each type and color and receive approval by Architect before full cleaning. Let test area dry 4 to 5 days before inspection. Keep test area for future comparison.

C. Wet surfaces with water before applying cleaner.

D. Apply cleaner to cast stone in accordance with manufacturer's instructions.

E. Brush on cleaner, let dwell for 2 to 3 minutes. Reapply cleaner, scrub surface with masonry brush and rinse off thoroughly. Areas with heavy soiling use a wood block or non-metallic scraper.

F. Remove cleaner promptly by rinsing thoroughly with clear water.

G. Do not use acidic cleaners, power washing, sandblasting, or harsh cleaning materials or methods that would damage or discolor surfaces.

3.05 PROTECTION

A. Protect completed work from damage.

B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION

SECTION 05 1200

STRUCTURAL STEEL

PART 1 – GENERAL

1.1 SUMMARY:

A. Section Includes:

1. Structural steel work including schedules, notes and details showing size and location of members, typical connections, and type of steel required.
2. Structural steel is that work defined in American Institute of Steel Construction (AISC) "Code of Standard Practice" and as otherwise shown on drawings.
3. Related work specified elsewhere:
   a. Miscellaneous Metal Fabrications are specified elsewhere in Division 5
   b. Refer to Division 3 for anchor bolt installation in concrete, Division 4 for anchor bolt installation in masonry.

B. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 05 5000, "Metal Fabrications": Loose steel bearing plates and miscellaneous steel framing.

1.2 PERFORMANCE REQUIREMENTS:

A. Structural Performance: Engineer structural steel members and connections required by the Contract Documents to be selected or completed by the fabricator to withstand design loadings indicated.

B. Design of Members and Connections: Details shown are typical, similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.

1.3 SUBMITTALS:

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

1. Submit all shop drawings on one reproducible print (sepia) and two blue line prints only. The reproducible print will be returned. All blue line prints required by the contractor are the responsibility of the Contractor and shall be made after reproducible is returned.

B. Product Data or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards). This data is submitted for information only.

1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.
2. High-strength bolts (each type), including nuts and washers.
   a. Include Direct Tension Indicators if used.
3. Structural steel primer paint.
4. Shrinkage-resistant grout.
5. Welder's certificates
6. Submit evidence of fabricator and erector qualifications.

C. Shop Drawings prepared under the supervision of, signed and sealed by a Licensed Professional Engineer, including complete details and schedules for fabrication and assembly of structural steel members, procedures and diagrams.

1. Include details of cuts, connections, camber, holes, and other pertinent data.
2. Welds: Indicate welds by standard AWS A2.1 and A2.4 symbols. Distinguishing between shop and field welds, and show size, length, and type of each weld.
3. Bolts: Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.
4. Setting Drawings: Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorage's to be installed by others.
5. Erection Drawings: Prepare and furnish to the Architect for review, erection drawings, detailed shop drawings and connection design calculations for all structural steel. Manufacturing of any material or performing of any work before final review of shop drawings will be entirely at risk.
6. Contract documents shall not be used for shop drawing, including erection plans or details.
7. All shop drawings which are resubmitted for any reason shall have all revised items clouded or identified for each submittal.
8. Fabrication, assembly and erection shall conform to reviewed shop drawings.

D. Connection Calculations:

1. All structural steel connections not specifically detailed on the drawings shall be designed to resist forces indicated, by the Contractor, under the direct supervision of a professional engineer registered in the State of Alabama.
2. Design calculations for the connections designed by the Contractor shall be submitted for the files of the Architect and Engineer. Calculations shall bear the seal of a professional engineer registered in the State of Alabama. Shop drawings containing connections for which calculations have not been received will be returned unchecked as an incomplete submittal.
3. For each connection, the following shall be noted on the shop drawings:
4. Required design reaction.
5. Calculation sheet number for design.
6. Capacity of detailed connection.

E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.

1. Structural steel, including chemical and physical properties.
2. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Shear stud connectors.
5. Shop primers.
6. Nonshrink grout.

1.4 QUALITY ASSURANCE:

A. Erector Qualifications: Engage an experienced Erector who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

C. Codes and Standards: Comply with provisions of following, except as otherwise indicated:

1. AISC's "Specification for Structural Steel Buildings—Allowable Stress Design and Plastic Design."
2. AISC's "Load and Resistance Factor Design (LFRD) Specification for Structural Steel Buildings."
3. AISC "Specifications for Structural Steel Buildings, Section 10, Architecturally Exposed Structural Steel."
4. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
5. AISC's "Specification for Load and Resistance Factor Design of Single-Angle Members."
6. AISC's "Seismic Provisions for Structural Steel Buildings."
7. American Institute of Steel Construction (AISC) "Code of Standard Practice for Steel Buildings and Bridges", dated June 10, 1992
   a. General:AISC "Code of Standard Practice" shall apply except to the extend that references are made to the responsibility of the Owner and/or Architect or Engineer in which event those references shall have no applicability. Where a conflict exists between the Code of Standard Practice and the Contract Documents, the Contract Documents shall govern.
   b. Paragraph 3.1:Add the following: "3.1.8 Include in the bid price for the work structural steel members shown on drawings, but not identified as to size, section, and material grade by assuming sizes, sections, and material grades shown for similarly loaded members having approximately the same overall

length except on areas that are noted on the drawings as incomplete. Identify such members and their associated cost in the bid for the work".

c. Paragraph 3.3:Delete the first sentence, "In case of discrepancies between plans and specifications for buildings, the specifications govern", and insert the following in its place, "In case of discrepancies between drawings and specifications for buildings, the drawings govern".

d. Paragraph 3.4:In the first sentence, delete the phrase "and made to a scale not less than 1.8" to the foot".

e. Paragraph 5.1:Delete the first sentence, "When the fabricator receives 'released for construction' plans and specifications, the fabricator may immediately place orders for the material necessary for fabrication". and insert the following in its place "when the fabricator receives 'issued for structural steel mill order of wide flange beams, girders and columns only' plans and specifications, the fabricator may immediately place orders for the material necessary for fabrication". Delete the second sentence, "The contract documents must note any materials or areas which should not be ordered due to a design which is incomplete or subject to revision".

8. ASTM A 6 (ASTM A 6M) "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
9. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
10. Research Council on Structural Connections' (RCSC) "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code—Steel."

E. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification in the past year.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.6 SEQUENCING:

A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

1.7 TESTING SERVICES:

A. Provide the Testing Laboratory with the following:

1. A complete set of shop and erection drawings reviewed by the Architect.
2. Mill test reports, cutting lists, order sheets, material bills and welder's certificates.
3. Full and ample means and assistance for testing all material.
4. Proper facilities, including scaffolding, temporary work platforms, hoisting facilities, etc., for inspection of the work in the mills, shop and field.

B. Propose procedures, acceptable to the Architect, to correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements.

C. Provide additional tests, by the Quality Control Testing Laboratory, as may be necessary, to reconfirm any noncompliance of the original work, and as may be necessary to show compliance off corrected work.

PART 2 – PRODUCTS

2.1 STEEL MATERIALS:

A. Metal Surfaces, General: For fabrication of work that will be exposed to view, use only materials that are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and applying surface finishes.

B. Structural Steel Shapes, Plates, and Bars: As follows:

1. Carbon Steel: ASTM A 36 (ASTM A 36M).
2. High-Strength, Low-Alloy Columbium-Vanadium Steel: ASTM A 572 (ASTM A 572M), Grade 50.

C. Cold-Formed Structural Steel Tubing: ASTM A 500, Grade B.

D. Hot-Formed Structural Steel Tubing: ASTM A 501.

E. Steel Pipe: ASTM A 53, Type E or S, Grade B.

1. Finish: Black, except where indicated to be galvanized.

F. Connection Material: Unless noted otherwise on the drawings, stiffener plates, doubler plates, gusset plates and the connecting plates shall be the same grade of steel as members being connected.

1. Finish: Black, except where indicated to be galvanized.

G. Shear Connectors: ASTM A 108, Grade 1015 through 1020, headed-stud type, cold-finished carbon steel, AWS D1.1, Type B.

H. Anchor Rods, Bolts, Nuts, and Washers: As follows:

1. Unheaded Rods: ASTM A 36 (ASTM A 36M).

2. Headed Bolts: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel, hex-head bolts; and carbon-steel nuts.
3. Washers: ASTM A 36 (ASTM A 36M).

I. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain, uncoated.

J. Welding Electrodes: Comply with AWS requirements.

2.2 PRIMER:

A. Primer: SSPC-Paint 15, Type I, red oxide.

2.3 GROUT:

A. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application, and a 30-minute working time. Subject to compliance with requirements, provide one of the following:

1. High Performance (Non-Metallic):
   a. “Masterflow 928”; Master Builders.
   b. “Crystex”; L & M Const. Chemical Co.
2. Construction Grade (Non-Metallic):
   a. “Set Grout”; Master Builders.
   b. “Euco-NS Grout”; Euclid Chemical Co.
   c. “Duragrout”; L & M Const. Chemical Co.
   d. “Horn Non-Corrosive Non-Shrink Grout”; A.C. Horn, Inc.
   e. “588 Grout”; W.R. Meadows, Inc.
   f. “Five Stair Grout”; Five Star Products, Inc.

2.4 FABRICATION:

A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.

1. Camber structural steel members where indicated.
2. Identify high-strength structural steel according to ASTM A 6 (ASTM A 6M) and maintain markings until steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
6. Comply with fabrication tolerance limits of AISC’s “Code of Standard Practice for Steel Buildings and Bridges” for structural steel.
7. Piping and/or cracks in flanges or webs of all rolled shapes or plates are to be removed and welded solid by AISC procedures.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded.

C. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.

D. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's printed instructions.

E. Steel Wall Framing: Select true and straight members for fabricating steel wall framing to be attached to structural steel framing. Straighten as required to provide uniform, square, and true members in completed wall framing.

F. Welded Door Frames: Build up welded door frames attached to structural steel framing. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches (250 mm) o.c., unless otherwise indicated.

G. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.

1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.

H. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.

I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Shop weld shear connectors, spaced as shown, to beams and girders in composite construction. Use automatic end welding of headed stud shear connectors in accordance with manufacturer's printed instructions.

2.5 SHOP CONNECTIONS:

A. Simple Beam Connections: Standard double angle framed beam connections using bolts as specified.

1. Seated Beam Connections and Stiffened Seated Beam Connections shall not be used unless indicated on the drawings or unless Engineer approval is obtained to verify capacity of supporting member for the resulting eccentricity. The fabricator must verify and bear responsibility that the use of such connections does not interfere with architectural or MEP requirements.

B. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.

C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.

2.6 SHOP PRIMING:

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed-on fireproofing, [unless otherwise specified].
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:

1. SSPC-SP 2 “Hand Tool Cleaning.”

2.7 SOURCE QUALITY CONTROL:

A. Independent Testing and Inspecting Laboratory: Owner will engage an Independent Testing and Inspecting Laboratory to perform shop inspections and tests and to prepare test reports.

1. Testing laboratory will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
2. Provide testing laboratory with access to places where structural steel work is being fabricated or produced so required inspection and testing can be accomplished.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor’s expense, will be performed to determine compliance of corrected Work with specified requirements.

D. Shop-bolted connections will be tested and inspected according to RCSC’s “Specification for Structural Joints Using ASTM A325 or A 490 Bolts”.

E. In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing laboratory’s option.

1. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
2. Ultrasonic Inspection:ASTM E 164.

PART 3 –EXECUTION:

3.1 INSPECTION:

A. Before erection proceeds, and with the steel erector present, verify elevations of concrete [and masonry bearing surfaces] and locations of anchorage's for compliance with requirements.

B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION:

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

B. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

3.3 ERECTION:

A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.

B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
   a. Comply with manufacturer's instructions for proprietary grout materials.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.

2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection.

H. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS:

A. Install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.

B. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds ½ inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.

D. Shear Connectors:Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld shear connectors in field, spaced as shown, to beams and girders in composite construction. Use automatic end welding of headed stud shear connectors in accordance with manufacturer's printed instructions.

3.5 FIELD QUALITY CONTROL:

A. Testing Laboratory Responsibility: The Owner's Testing Laboratory will perform field inspections and tests on and to prepare test reports as follows:

1. Testing Laboratory shall also approve welding certificates. Contractor shall submit three (3) copies of welding certificates and procedures for each welder involved in the Work.
2. Testing Laboratory shall conduct and interpret tests, certificates and procedures and state in each report whether tested Work complies with or deviates from requirements.

B. Quantity of Required Inspections and Tests: Testing Laboratory shall perform the following inspections or tests:

1. Shop Bolted Connections: Inspect or test in accordance with AISC specifications. Inspect ten percent (10%) of all bolts, but not less than two (2) bolts of each connection.
2. Shop Welded Connections: Inspect ten percent (10%) of all welds, other than visual, but not less than one (1) weld at each connection.

C. Provide access for Testing Laboratory to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.

D. Deficiencies: Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

E. Field Inspections and Tests: check steel as received in the field for possible shipping damage workmanship, piece making and verification of required camber.

F. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

G. Field-Bolted Connections: Inspect in accordance with AISC specification.

1. For non-slip critical bolted connections (bearing-type), all connections shall be visually observed to assure that all bolts, nuts and washers are in place and that all plies of connection material have been drawn together. All bolts shall be verified to be snug tight only.
2. For slip critical bolted connections (friction-type), all connections shall be visually observed to assure that all bolts, nuts and washers are in place and that all plies of connection material have been drawn together. 50% of all bolts, but not fewer than 25% of the bolts in any one connection shall be tested to assure proper pretension in accordance with AISC specifications.
3. Bolts in slotted holes at expansion joints shall have nuts finger tight with threads damaged.

H. Field Welding: Inspect and test during erection of structural steel as follows:

1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
2. Perform visual inspection of all welds, including but not limited to fit-up, intermediate passes and final weld.
3. Perform tests of welds as follows:
   a. Magnetic Particle Inspection:ASTM E709; performed on root pass and on finished weld. Inspect 20% of the length of each fillet weld. Cracks or zones of incomplete inspected on less than 100% basis shall require inspection of 100% of that weld.
   b. Ultrasonic Inspection:ASTM E164. Perform on all full and partial penetration welds.

3.6 CLEANING

A. Touch up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils (0.038 mm).

B. Touch up Painting: Cleaning and touch up painting of field welds, bolted connections, and abraded areas of shop paint on structural steel are included in Section 09900, “Painting.”

END OF STRUCTURAL STEEL

SECTION 05 3100

STEEL DECK

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:

1. Steel roof deck.

B. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 05 1200, "Structural Steel": Shop-welded shear connectors.
2. Section 05 5000, "Metal Fabrications": Framing openings with miscellaneous steel shapes.
3. Section 05 2100, “Steel Joists”.
4. Section 07 8150, "Sprayed-On Fireproofing".
5. Section 09 9000, "Painting":
   a. Touch-up and repair painting of deck.
   b. Touch-up and repair of special deck coatings.

1.2 SUBMITTALS:

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Submit all shop drawings on one reproducible print (sepia) and one blue line print only. The reproducible print will be returned. All blue line prints required by the Contractor will be the responsibility of the Contractor and shall be made after reproducible is returned.

C. Product data for each type of deck, accessory, and product specified.

1. Provide test data for mechanical fasteners used in lieu of welding for fastening deck to supporting structures.

D. Shop drawings showing layout and types of deck panels, anchorage details, reinforcing channels, pans, cut openings, closure strips, deck openings, special jointing, accessories, and attachments to other construction.

E. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

F. Product test reports from qualified independent testing agencies evidencing compliance with requirements of the following based on comprehensive testing:

1. Mechanical fasteners.

G. Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence steel deck's compliance with the building code in effect for the Project.

1.3 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of the following codes and standards, except as otherwise indicated:

1. American Iron and Steel Institute (AISC), “Specification for the Design of Cold-Formed Steel Structural Members”.
2. American Welding Society (AWS), D1.3 “Structural Welding Code - Sheet Steel”.
3. Steel Deck Institute (SDI), ‘’Design Manual for Composite Decks, Form Decks and Roof Decks’’.

B. Installer Qualifications: Engage an experienced Installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code-Steel" and AWS D1.3 "Structural Welding Code-Sheet Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

D. Welded decking in place is subject to inspection and testing. Owner will bear expense of removing and replacing portions of decking for testing purposes if welds are found to be satisfactory. Remove work found to be defective and replace with new acceptable work.

E. Fire-Test-Response Characteristics: Where indicated, provide steel deck panels identical to those tested as part of an assembly for fire resistance per ASTM E 119 by a testing and inspection agency performing testing and follow-up services, that is acceptable to authorities having jurisdiction.

F. Fire-Resistance Ratings: As indicated by design designations listed in UL "Fire Resistance Directory," or by Warnock Hersey or another testing and inspecting agency.

G. Labeling: Identify steel deck with appropriate markings of applicable testing and inspecting agency.

H. Installation Tolerances: Conform to the installation tolerances specified in Part 3.

1.4 DELIVERY, STORAGE, AND HANDLING:

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1.5 COORDINATION:

A. Coordinate installation of sound-absorbing insulation strips in acoustic deck ribs with related units of Work specified in other Sections to ensure that the insulation is protected against damage from effects of the weather and other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Roof Deck:
   a. Vulcraft Div. of Nucor Corp.
   b. New Millennium Building Systems.
   c. Epic Metals Corp.
   d. Bowman Metal Deck Armco, Inc.
   e. Wiremold/Walker.
   f. Wheeling Corrugating Co., Div. of Wheeling-Pittsburgh Steel Corp.

2.2 ROOF DECK:

A. Steel Roof Deck: Fabricate panels without top-flange stiffening grooves conforming to SDI Publication No. 28 "Specifications and Commentary for Steel Roof Deck" and the following:

1. Galvanized-Steel Sheet: ASTM A 446, Grade A, G 60 (ASTM A 446M, Grade A, Z 180) zinc coated according to ASTM A 525 (ASTM A 525M).
2. Deck Profile:
   a. Type WR, wide rib. Vented deck at light gauge roof trusses.
3. Profile Depth:
   a. 1-1/2 inches.
4. Design Uncoated-Steel Thickness:
   a. 0.0295 inch.
5. Span Condition:
   a. Triple span or more.
6. Side Joints:
   a. Overlapped or interlocking seam at Contractor's option.

2.3 FABRICATION AND ACCESSORIES:

A. General: Form deck units in lengths of three or more spans, with flush, telescoped, or nested 2-inch laps at ends and interlocking or nested side laps, unless noted. End laps shall occur over a support.

B. Roof Deck Units: Provide deck configurations that comply with SDI "Specifications and Commentary for Steel Roof Deck".

C. Cant Strips: Fabricate cant strips of not less than 20 gage galvanized sheet steel of same quality as the deck units. Bend cant strips to form a 45 degree cant not less than 5 inches wide with top and bottom flanges not less than 2 inches wide, unless noted. Provide cant strips in 10 foot lengths where possible.

D. Ridge and Valley Plates: Fabricate ridge and valley plates of not less than 20 gage galvanized sheet steel of the same quality as deck units. Bend to provide tight-fitting closure with deck units. Each leg of bend shall not be less than 3 inches. Provide plates in 10 foot lengths where possible.

E. Accessories: Provide accessory materials for steel deck that comply with requirements indicated and recommendations of the steel deck manufacturer.

F. Mechanical Fasteners: Manufacturer's standard, corrosion-resistant, low-velocity, powder-actuated or pneumatically driven carbon steel fasteners; or self-drilling, self-threading screws.

G. Side Lap Fasteners: Manufacturer's standard, corrosion-resistant, hexagonal washer head; self-drilling, carbon steel screws, No. 10 (4.8 mm) minimum diameter.

H. Rib Closure Strips: Manufacturer's standard vulcanized, closed-cell, synthetic rubber.

I. Miscellaneous Roof Deck Accessories: Steel sheet, 0.0359-inch (0.91-mm) thick minimum ridge and valley plates, finish strips, and reinforcing channels, of same material as roof deck.

J. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material and thickness as deck panels, unless otherwise indicated.

K. Weld Washers: Manufacturer's standard uncoated-steel sheet weld washers, shaped to fit deck rib, 0.0598 inch (1.5 mm) thick with 3/8-inch (9.5-mm) minimum diameter prepunched hole.

L. Recessed Sump Pans: Manufacturer's standard size, single piece steel sheet 0.071-inch- (1.8-mm-) thick minimum, of same material as deck panels, with 1-1/2-inch- (38-mm-) minimum deep level recessed pans and 3-inch- (76-mm-) wide flanges. Cut holes for drains in the field.

M. Flat Receiver Pan: Manufacturer's standard size, single-piece steel sheet, 0.071-inch- (1.8-mm-) thick minimum units, of same material as deck panels. Cut holes for drains in the field.

N. Shear Connectors: ASTM A 108, Grade 1010 through 1020 headed stud type, cold-finished carbon steel, AWS D1.1, Type B.

O. Steel Sheet Accessories: ASTM A 446, G 60 (ASTM A 446M, Z 180) coating class, galvanized according to ASTM A 525 (ASTM A 525M).

P. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine supporting framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of steel deck.

3.2 PREPARATION:

A. Do not place deck panels on concrete supporting structure until concrete has cured and is dry.

B. Locate decking bundles to prevent overloading of supporting members.

3.3 INSTALLATION, GENERAL:

A. Install deck panels and accessories according to applicable specifications and commentary of SDI Publication No. 28, manufacturer's recommendations, and requirements of this Section.

B. Install temporary shoring before placing deck panels when required to meet deflection limitations.

C. Place deck panels on supporting framing and adjust to final position with ends accurately aligned and bearing on supporting framing before being permanently fastened. Do not stretch or contract side lap interlocks.

1. Do not place deck units on concrete supporting structure until concrete has cured and is dry.
2. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
3. Do not use deck units for storage or working platforms until permanently secured.
4. Place deck panels flat and square and fasten to supporting framing without warp or deflection.
5. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to the decking.
6. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.
7. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
8. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's instructions.

D. Deck Edge Tolerances: Perimeter deck edges shall be within =/- 1/2 inch of the indicated lines.

3.4 ROOF DECK INSTALLATION:

A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter, but not less than 1-1/2 inches (38 mm) long, and as follows:

1. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
2. Weld Diameter:
   a. 5/8 inch (16 mm), nominal.
3. Weld Spacing: Space and locate welds as indicated.
4. Weld Washers: Install weld washers at each weld location.
5. Side Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding 36 inches (910 mm), using one of the following methods:
   a. Mechanically fasten with self-drilling No. 10- (4.8-mm-) diameter or larger carbon steel screws.

B. End Bearing: Install deck ends over supporting framing with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints:
   a. Lapped 2 inches (51 mm) minimum.

C. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 45 psf at eave overhang and 30 psf for other roof areas.

D. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.

E. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking, and weld flanges to top of deck. Space welds not more than 12 inches (305 mm) apart with at least one weld at each corner.

F. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's recommendations. Weld to substrate to provide a complete deck installation.

3.5 FIELD QUALITY CONTROL:

A. Testing Agency: A qualified independent testing agency employed and paid Owner will perform field quality-control testing.

1. Field welds will be subject to inspection.

B. Testing Agency will report test results promptly and in writing to Contractor and Architect.

C. Remove and replace work that does not comply with specified requirements.

D. Additional testing will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION:

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces with galvanized repair paint according to ASTM A 780 and the manufacturer's instructions.

END OF STEEL DECK

SECTION 05 4000
COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud exterior wall framing.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 04 2000 - Unit Masonry: Veneer masonry supported by wall stud metal framing.

C. Section 05 3100 - Steel Decking.

D. Section 06 1000 - Rough Carpentry: Wood blocking and miscellaneous framing.

E. Section 07 2100 - Thermal Insulation: Insulation within framing members.

F. Section 09 5100 - Acoustical Ceilings: Ceiling suspension system.

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

E. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).

F. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to metal framing systems, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.05 SYSTEM DESCRIPTION

A. Horizontal Deflection: Design to permit maximum deflection of l/600 of span.

B. Vertical Deflection: Design non-axial loadbearing framing to accommodate not less than 1/2 in (13 mm) vertical deflection.

C. Design wall system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.

D. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

E. Work described in this Section includes galvanized steel stud framing systems for use at any new exterior metal stud walls and framing, interior load-bearing walls, and other locations as indicated on drawings.

1. Studs and runner tracks at exterior walls and interior load-bearing walls (if any) shall be 6-inches depth x 1-5/8-inches width x gauge indicated on the Drawings, and spaced at sixteen inches (16") o.c., unless otherwise indicated, with continuous bridging channels

and/or stud tracks as bridging channels, as indicated, and framed structural headers at all openings.

2. Joists and rafters (if any) and their stringers (at ends over bearing locations), bridging, and web stiffeners shall be as indicated herein, unless indicated otherwise on the Drawings; joists shall be spaced sixteen (16) inches o.c., directly over bearing studs or immediately adjacent to studs where anchored to sides of stud walls, unless otherwise indicated or accepted in writing by Architect.
3. Typical stud and joist sections shall be C-shape, and at least 1-5/8-inches width.
4. Galvanized steel strap bracing shall be provided, continuous at top and bottom runner tracks and at bridging locations at all curved stud walls.
5. Structural channels, studs, and joists, and other framing shall be as indicated on the Structural Drawings.

1.06 SUBMITTALS

A. See Section for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.

C. Product Data: For lateral-force resisting systems, provide product data sheets on hold-down, showing compliance with requirements.

D. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
   1. Indicate stud and ceiling joist layout.
   2. Describe method for securing studs to tracks and for bolted or welded framing connections.

E. Manufacturer's Installation Instructions: For lateral-force resisting systems, indicate welding procedure specifications.

F. Shop drawings shall bear the current State seal and license number of the manufacturer's and/or fabricator's Design Engineer.

1.07 QUALITY ASSURANCE

A. Designer Qualifications: Design framing system under direct supervision of a professional structural engineer experienced in designing this work and licensed in the State in which the Project is located.

B. Calculate structural properties of framing members in accordance with requirements of AISI North American Specification for the Design of Cold-Formed Steel Structural Members.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

D. Design structural elements under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

1.08 MOCK-UP

A. Construct a representative wall sample, 6 feet wide by 10 feet high, which includes face brick, mortar and accessories, architectural masonry veneer, cast stone, metal-framed storefronts, with masonry back-up and metal stud and sheathing backup where applicable; with accompanying flashing, sealants, and waterproofing (air barrier). Also, eave condition, including soffit and gutter is included. This panel will be for the purpose of approving the wall system and its components.

B. Locate where directed.

C. Coordinate with work of other Sections.

D. Approved mock-up will become standard for appearance and workmanship.

E. Mock-up may not remain as part of the Work.

F. Protect mock-ups from the elements with weather-resistant membrane.

G. When directed, demolish and remove mock-ups from Project site.

1.09 PROJECT CONDITIONS

A. Verify that field measurements are as indicated on shop drawings.

B. Coordinate work of this section with the placement of components within the stud framing system as specified in Section 09 2116 - Gypsum Board Assemblies.

1.10 DELIVERY, STORAGE AND HANDLING

A. Protect metal framing units from rusting and damage. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off ground in a dry ventilated space or protect with breathable waterproof tarpaulins.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Structural Framing:
1. Bostwick Steel Framing Co.
2. Dale Industries Inc.
3. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
4. The Formetal Company, Inc.: email: formetal@bellsouth.net.
5. Harrison Manufacturing Co.
6. MBA Metal Framing: www.mbastuds.com.
7. Milcor Division, Inryco Inc.
8. Unimast Incorporated
9. U.S. Gypsum Co
10. Substitutions: See Section 01 6000 - Product Requirements. .

B. Connectors:

2.02 PERFORMANCE REQUIREMENTS

A. Design Requirements: Design cold-formed framing systems, components and connectors to withstand specified design loads in compliance with ICC (IBC), ASCE 7, AISI S100, and AISI S240.

2.03 STRUCTURAL FRAMING COMPONENTS

A. Wall Studs and Track Sections: AISI S240; c-shaped studs and u-shaped track sections in stud-matching nominal width and compatible height.

B. System Components: With each type of metal framing and headers required, provide manufacturer's standard steel runners (tracks), blocking, bridging, lintels, clip angles, shoes, reinforcements, fasteners, and accessories as recommended by manufacturer for applications indicated, as needed to provide a complete metal framing system.

C. Materials and Finishes:
1. For 16-gage and heavier units, fabricate metal framing components of structural quality steel sheet with a minimum yield point of 40,000 psi; ASTM A 446, A 570, or A 611.
2. For 18-gage and lighter units, fabricate metal framing components of commercial quality steel sheet with a minimum yield point of 33,000 psi; ASTM A 446, A 570, or A 611.
3. Provide galvanized finish to metal framing components complying with ASTM A 525 for minimum G60 coating.
a. Finish of installation accessories to match that of main framing components, unless otherwise indicated.

2.04 ACCESSORIES

A. Stud Wall Bridging: 1-1/2-inches x 16-gage Cold Rolled Channel, unless otherwise indicated, anchored to each stud with 16-gage clip angles, or welded connections (where allowed by

manufacturer), and 16-gage splice plates, with spacing at 4'-0" or 4'-6" o.c. vertically, through pre-punched slots in studs.

B. Solid Joist Bridging: 1-5/8-inches x same gauge and depth as joists, unless otherwise indicated, anchored to joists webs with 2-inch x 2-inch x 16-gauge clip angles, or welded (where allowed by manufacturer) with continuous rows spaced at mid-span minimum, or 5'-0" o.c. maximum at clear span where span exceeds 10'-0".

C. Strap Bracing: 1-1/2-inches x 20-gage galvanized steel, anchored at ends, splices, and each stud with typical framing screws. Placement at curved walls shall align with radius or curve indicated at each such location.

D. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.

E. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.05 FASTENERS

A. Anchorage Devices: Power actuated and Screws with sleeves.

B. Electrodes for Welding: Comply with AWS Code.

2.06 FABRICATION

A. General: Framing components may be prefabricated into assemblies before erection. Fabricate panels plumb, square, true to line, and braced against racking with joints welded. Perform lifting of prefabricated units to prevent damage or distortion.

B. Fabricate units in jig templates to hold members in proper alignment and position and to assure consistent component placement.

C. Fastenings: Attach similar components by welding. Attach dissimilar components by welding, bolting, or screw fasteners, as standard with manufacturer. Wire tying of framing components is not permitted.
   1. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

D. Fabrication Tolerances: Fabricate units to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8-inch in 10 feet, and as follows:
   1. Spacing: Space individual framing members no more than plus or minus 1/8-inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
   2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8-inch (3 mm).

E. Headers: Form from at least two equal size C-shapes in a back-to-back or box type configuration.

2.07 SHOP FABRICATED ASSEMBLIES

A. Shop fabricate metal framing to the greatest extent possible.

B. Fabricate assemblies of framed sections of sizes and profiles required; with framing members fitted, reinforced, and braced to suit design requirements.

C. Fit and assemble in largest practical sections for delivery to site, ready for installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION - GENERAL

A. Manufacturer's Instructions: Install metal framing system in accordance with manufacturer's current printed or written instructions and recommendations, unless otherwise indicated.

B. Runner Tracks:
   1. Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks at all walls anchored to concrete floor and roof structure with threaded studs in expansion shields spaced 18-inches o.c., unless otherwise indicated.
   2. Track shall be spliced with channel insert fastened with two (2) sheet metal screws, bolts or rivets at each side, each flange, each corner. Provide fasteners at corners and ends of tracks.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

D. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners and bridging to supporting structure.

E. Install supplemental framing, blocking and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.

F. Erection Tolerances: Bolt or weld panels (at both horizontal and vertical junctures) to produce flush, even, true to line joints.
   1. Step in face and jog in alignment between panels not to exceed 1/16-inch.

3.03 INSTALLATION OF STUDS

A. Install wall studs plumb and level.

B. Frame wall openings larger than 2'-0" square with double stud at each jamb of frame except where more than two (2) are either shown or indicated in manufacturer's written instructions. Install cripple studs below and king studs and jack studs on each side/end of headers, minimum same size and gauge as wall studs where occurs, and anchor together securely. Install runner tracks and jack studs above and below headers at wall openings. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of wall. Secure stud system wall opening frame in manner indicated. Attach structural sheathing to each component.

C. Install horizontal bridging in all walls, and the additional strap bracing at curved walls as steel framing progresses. Install at spacing indicated and in compliance with stud manufacturer's written recommendations.

D. Frame both sides of expansion and control joints, with separate studs; do not bridge the joint with components of stud system

E. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

F. Install load-bearing studs full length in one piece. Splicing of studs is not permitted.

G. Install load-bearing studs; brace, and reinforce to develop full strength and achieve design requirements.

H. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

I. Install intermediate studs above and below openings to align with wall stud spacing.

J. Provide deflection allowance in stud track, directly below horizontal building framing at non-loadbearing framing.

K. Attach cross studs to studs for attachment of fixtures anchored to walls.

L. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

M. Touch-up field welds and damaged corrosion protected surfaces with primer.

3.04 FIELD QUALITY CONTROL

A. Testing (if required): All field quality-control testing shall be performed by a qualified independent testing agency. Refer to Section 01 0150 - “Special Conditions” for additional information and requirements.
   1. Field and shop welds will be subject to inspection and testing.
   2. Testing agency will report test results promptly and in writing to Contractor and Architect.
   3. Remove and replace Work that does not comply with specified requirements.
   4. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

3.05 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

3.06 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch (____ mm).

B. Maximum Variation of any Member from Plane: 1/16 inch (____ mm).

END OF SECTION

SECTION 05 4500

LIGHT GAUGE STEEL TRUSSES

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:

1. Gable-shaped trusses.
2. Cold-formed steel framing accessories.
3. Anchorage, bracing and bridging.

B. Definitions:

1. Pre-engineered light gauge steel trusses include planar structural units consisting of welded, screwed or bolted connected members which are fabricated, cut and assembled prior to delivery to the job site.

C. Miscellaneous Metal Fabrications including embed plates shown on the drawings are specified elsewhere in Division 5.

D. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work specified in this section.

E. Related Sections:
1. Section 05 3100 – Steel Deck
2. Section 05 4000 – Cold-formed Metal Framing

F. Design Requirements:
1. Design system components in accordance with AISI references.
2. Conform to the requirements of the Standard Building Code.
3. Maximum allowable deflections:
   a. $1/240^{th}$ of span under total loads
   b. $1/360^{th}$ of span under live loads.

1.2 SUBMITTALS:

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

1. Submit all shop drawings on one reproducible print (sepia) and one blue line print only.
2. The reproducible print will be returned. All blue line prints required by the Contractor are the responsibility of the Contractor and shall be made after reproducible is returned.

B. Product Data: Submit fabricator's technical data covering materials, shapes, hardware, fabrication process, handling and erection.

C. Shop Drawings: Submit shop drawings showing shapes and dimensions of members to be used including pitch, span, camber configuration and spacing for each type or configuration of truss required. Show all bearing and anchorage details. Specify and detail all supplemental strapping, bracing clips and other accessories required for proper installations, including temporary bracing and permanent member bracing. Shop drawings shall include all placement sequences and instructions.

1. Submit design analysis and test reports indicating loading, section properties, allowable stress, stress diagrams and calculations, and similar information needed for analysis and to insure trusses comply with requirements.
2. All designs shall bear the name and seal of a Structural Engineer licensed to practice in the State of Alabama Shop drawings which do not contain this information will be returned unchecked.

D. Quality Control Programs:

1. Submit written and bound quality control program that includes procedures for product certification and truss engineering, fabrication, handling, delivery, temporary storage, and erection procedures.
2. Quality Control Manual will be used as basis for inspection by a testing agency engaged by the Owner to determine compliance with the Quality Control Manual and other tests and observations noted herein.

E. Architect's Shop Drawing Review:

1. Review of shop drawings will be for general considerations only. Compliance with requirements for materials, fabrication, and erection of structural steel is the Contractor's responsibility.
2. Submit all shop drawings on one reproducible copy and two blueline prints only. Only the reproducible will be returned. Additional bluelines required by the Contractor are the Contractor's responsibility and shall be made after reproducible is returned. If additional bluelines are submitted, they will be returned unmarked.

1.3 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of the following except as otherwise indicated.

1. AISI "Specification for the Design of Cold-Formed Steel Structural Members," dated August 19, 1986 with December 11, 1989 addendum and design guide for cold formed steel trusses, Publication RG=9518.
2. ASTM A370 "Standard Test Methods and Definitions for Mechanical Testing of Steel Products."
3. ASTM A446 "Specifications for Sheet Steel, Zinc Coated (Galvanized) by the Hot-Dip Process, Physical (Structural) Quality"
4. ASTM A500 "Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural tubing in Rounds and Shapes."
5. ASTM A653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) of Zinc Alloy Coated by the Hot-Dip Process."

6. ASTM A780-93a "Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings."
7. AWS D1.1 "Structural Welding Code for Steel
8. AWS D1.3 "Structural Welding Code for Sheet Steel."

B. Qualifications For Welding Work: Quality welding processes and welding operations in accordance with AWS D1.3 "Structural Welding Code for Sheet Steel."

1. Provide certification that welders to be employed in the work have satisfactorily passed AWS qualification tests within the previous 12 months.
2. If recertification of welders is required, retesting will be the Contractor's responsibility.

C. Design Of Members And Connections: All details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at the site without causing delay in the work.

1. Promptly notify the Architect whenever design of members and connections for any portion of the structure are not clearly indicated.

D. Trusses shall be designed, fabricated, and erected by a firm which has a record including a minimum of five years of successfully designing, fabricating, and erecting trusses assemblies similar to scope required and which practices a quality control program.

1. Engineer Qualifications: A professional engineer legally authorized to practice in the jurisdiction where the project is located and is experienced in the services of the kind indicated.

E. Fabricators who wish to qualify for approval under this Section of the specification shall submit evidence of compliance with this specification no later that ten (10) days prior to the bid date. Only those fabricators approved in writing by the Architect prior to the bid date will be accepted.

1.4 DELIVERY, STORAGE, AND HANDLING:

A. Deliver materials to the site at such intervals to insure uninterrupted progress of the work.

B. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

C. Do not store materials on structure in a manner that might cause distortion or damage to supporting structures.

D. Deliver and handle products in exact accordance with the manufacturer's latest published requirements and specifications to avoid damage from bending, overturning, or other cause for which truss is not designed to resist or endure.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Sheet Steel: ASTM A446 "specification for Sheet Steel, Zinc Coated Galvanized by the hot-Dip Process, Physical (Structural) Quality."

1. Grade A, Fy = 33ksi; 18 gage and lighter
2. Grade D, Fy = 50 ksi; gage and heavier
3. Galvanizing: G-60 Coating Class

B. Galvanizing: ASTM A653

C. Fasteners: ITW Buildex pan head screws and bolts or others submitted and approved by the Architect.

D. Electrodes for Welding: Comply with AWS Code

E. Paint: Zinc Chromate, Oil-alkyd; TT-P-57, Type I.

2.2 DESIGN:

A. All calculations and procedures pertaining to design, analysis, and computation of section properties shall be in accordance with the Specification for the Design of Cold-Formed Steel Structural Members of the American Iron and Steel Institute.

B. Design trusses for loads indicated on drawings plus concentrated loads hung from or supported on trusses. Refer to mechanical, electrical and plumbing drawings and specifications for loading information and location. Loading as required by other subcontractors, such as fire protection, shall be coordinated by the general contractor.

C. Holes in Members: Design for holes in members where shown for securing other work to trusses; however, deduct area of holes from the area of chord when calculating strength of member.

D. Design bridging and other temporary and permanent bracing for same loads as used to design trusses plus any temporary loads and permanent loads resulting laterally bracing of members.

2.3 FABRICATION:

A. Light gage steel trusses may be fabricated either on the jobsite or at fabricator's shop.

B. All trusses shall be fabricated and erected in strict accordance with the current printed instructions of the approved subcontractor or fabricator.

C. All truss components shall be straight and true prior to fabrication. Flattening or straightening of components, when necessary, shall be accomplished in a manner so as to not damage the component.

D. All truss components shall be cut neatly to fit snugly against adjacent members.

E. No splices will be allowed in trusses except as authorized in writing by the Architect or as shown on the approved shop drawings.

F. Framing components shall be field or shop fabricated and joined to one another by means of welding or through the use of screws.

G. Completed trusses shall be free from twists, bends, or open joints with all members straight and true to line.

H. Welds must be thoroughly cleaned and wire brushed and primed and painted with a high zinc content paint capable of providing an equal or greater degree of protection than the original G-60 galvanized coating.

2.4 BRIDGING:

A. Fabricate horizontal or diagonal type bridging for trusses as required to prevent buckling of members where sheathing applied to the truss members is not present or is not adequate to brace the truss member. Bridging shall transfer all forces to roof diaphragm.

2.5 END ANCHORAGE:

A. Fabricate end anchorage to secure trusses to adjacent construction.

B. Fabricate all clips, angles, henways and other miscellaneous pieces necessary to attach light gage steel trusses to the substructure or to attach other components within this section to one another.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Erector must examine areas, dimensions and conditions under which the trusses are to be installed, and notify Contractor and Architect in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Erector. Additionally, the following items shall be installed and inspected prior to roof truss installation.

3.2 CONDITIONS OF SURFACES:

A. Exterior and Interior Bearing Plates
   1. Properly positioned.
   2. Installed so as to allow complete and adequate contact with truss connection member.

B. Exterior and Interior Bearing Plates installed in proper elevations so as to permit the installation of the truss system without the use of shims or adjustability.

3.3 PREPARATION:

A. Structural Adequacy: Contractor shall prepare the structure to insure proper and adequate structural support for the materials specified.

3.4 ERECTION:

A. Prefabricated trusses shall be braced against racking. Lifting of trusses shall be done so as to not cause local distortion in any member.

B. All light gage steel framing shall be erected using equipment of adequate capacity to safely perform the work.

C. The Contractor is responsible for checking the dimensions and assuring the fit of all members and trusses before erection begins.

D. All work shall be erected plumb and level and to dimensions and spacings indicated on the drawings. Provide bridging as shown in the shop drawings.

E. Assemblies shall be of the size and spacing shown on the approved shop drawings.

F. Provide web stiffeners and reinforcement at reaction points where required by analysis or to suit details.

G. Hoist units in place by means of lifting equipment suited to sizes and types of trusses required, applied at designated lift points as recommended by fabricator, exercising care not to damage truss members.

H. Provide temporary bracing as required to maintain trusses plumb, parallel and in location indicated, until permanent bracing is installed.

I. Anchor trusses securely at all bearing points to comply with methods and details indicated.

J. Install permanent bracing and related components to enable trusses to maintain design spacing, withstand design loads, and comply with other indicated requirements.

K. Do not cut or remove truss members.

3.5 TEMPORARY PLANKING:

A. Provide temporary planking and working platforms as necessary to effectively complete work.

3.6 FIELD ASSEMBLY:

A. Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening.

3.7 QUALITY CONTROL:

A. The Owner will engage an independent testing agency to perform shop and field inspection of trusses during fabrication.

B. Testing Agency shall conduct and interpret tests and state in each report whether observations and tests comply with the requirements and specifically state any deviations therefrom.

C. Provide Access for testing agency to places where truss work is being fabricated or produced so that required inspections, observations and testing can be accomplished.

D. Architect reserves the right, at any time before final acceptance, to reject material not complying with specified requirements regardless of when testing agency completed inspection, observation or testing.

E. Correct deficiencies in truss work which inspections and test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of correct work.

END OF LIGHT GAUGE STEEL TRUSSES

SECTION 05 5000
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items.

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.

B. Section 09 9100 - Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008 (Reaffirmed 2018).

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

G. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2025a.

H. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).

J. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

K. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

L. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 DESCRIPTION OF WORK

A. Work described in this section includes metal fabrications, which include items made from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems specified elsewhere. Types of work in this section includes metal fabrications for:

1. Rough hardware.
2. Loose bearing and leveling plates.
3. Loose steel lintels.
4. Miscellaneous framing and supports.
5. Ladder to attic hatch.
6. Guard posts (bollards), with concrete fill and matching metal domed cap welded on post.
7. Anchor plates, channels and/or angles with anchor bolts, as required for installation of prefabricated concrete bank vault assembly; galvanized.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Samples: Submit representative samples of materials and finished products as may be requested by Architect.

1.06 QUALITY ASSURANCE

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.07 PROJECT CONDITIONS

A. Field Measurements: Where fabrications are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabrication without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting acceptable to fabricator's professional engineer, and in a manner that will not affect structural performance, deflection, safety, etc.

1.08 COORDINATION

A. Coordinate installation of anchorages for metal fabrications and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation, without delaying the work of this section or the Work of the project.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.

F. Structural Steel Sheet: Hot-rolled, ASTM A 570; or cold-rolled ASTM A 611, Class 1; of grade required for design loading.

G. Galvanized Structural Sheet Steel: ASTM A 446, of grade required for design loading. Coating designation as indicated, or if not indicated, G90.

H. Steel Pipe: ASTM A 53; Type and grade (If applicable) as selected by fabricator and as required for design loading; black finish unless galvanizing is indicated; standard weight (schedule 40), unless otherwise indicated.

I. Gray Iron Castings: ASTM A 48, Class 30.

J. Malleable Iron Castings: ASTM A 47, grade as selected by fabricator.

K. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

L. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A 153

M. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

N. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

O. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ACCESSORIES

A. Grout: Non-Shrink Non-Metallic Grout: Pre-mixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with CE-CRD-C621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

B. Fasteners:
   1. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.

C. Paint:
   1. Metal Primer Paint: Southern Coating "Heavy Duty RIP Primer 1-0900", Tnemec "10-99 Primer", or approved equivalent.
   2. Primer selected must be compatible with finish coats of paint. Coordinate selection of metal primer with finish paint requirements specified in Section 09 9100 - Painting.
   3. Galvanizing Repair Paint: High zinc dust content paint for re-galvanizing welds in galvanized steel, complying with Military Specifications MIL-P-21035 (Ships), or SSPC-Paint-20.
   4. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.03 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
   1. Side Rails: 3/8 x 2 inches (9 x 50 mm) members spaced at 20 inches (500 mm).
   2. Rungs: one inch (25 mm) diameter solid round bar spaced 12 inches (300 mm) on center.
   3. Space rungs 7 inches (175 mm) from wall surface.

B. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; galvanized finish.

C. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.

D. Lintels: As detailed; galvanized finish.

E. Miscellaneous framing and supports:
   1. Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete work.

2. Fabricate miscellaneous units to sizes, shapes and profiles shown or, if not shown, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
3. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed. Except as otherwise shown, space anchors 24-inches o.c. and provide minimum anchor units of 1-1/4-inches wide x 1/4-inch x 8-inch long steel straps.
4. Galvanize exterior miscellaneous frames and supports

F. Rough hardware:
1. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in DIVISION 6 sections.
2. Fabricate items of sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2.05 FINISHES - STEEL

A. Prime paint steel items.
1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Surface Preparation:
1. Prepare ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specification and environmental exposure conditions of installed metal fabrications:
2. Exterior (SSPC Zone 1B): SSPC-SP6 "Commercial Blast Cleaning."
3. Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning."

E. Prime Painting: One coat.

F. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.

G. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

H. ASTM A 386 for galvanizing assembled steel products.

2.06 FABRICATION GENERAL

A. Workmanship:
1. Use materials of size and thickness shown or, if not shown, of required size and thickness to produce strength and durability in finished product. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.
2. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32-inch unless otherwise shown. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
3. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

4. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown, or if not shown, Phillips flat-head (countersunk) screws or bolts.
5. Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
6. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.
7. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

2.07 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).

D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).

E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

C. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

D. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete insets, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

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SECTION 06 1000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rough opening framing for doors, windows, and roof openings.
B. Sheathing.
C. Roof sheathing.
D. Roof-mounted curbs.
E. Roofing nailers.
F. Roofing cant strips.
G. Preservative treated wood materials.
H. Fire retardant treated wood materials.
I. Miscellaneous framing and sheathing.
J. Communications and electrical room mounting boards.
K. Concealed wood blocking, nailers, and supports.
L. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

A. Section 05 4500 - Light Gauge Steel Trusses: Prefabricated trusses for support of wood framing.
B. Section 05 5000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
C. Section 07 3113 - Asphalt Shingles: Shingles over sheathing.
D. Section 07 6200 - Sheet Metal Flashing and Trim: Sill flashings.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
B. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2024).
C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.
D. AWPA U1 - Use Category System: User Specification for Treated Wood; 2025.
E. PS 1 - Structural Plywood; 2023.
F. PS 20 - American Softwood Lumber Standard; 2025.
G. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber; 2019.
H. SPIB (GR) - Standard Grading Rules; 2021.
I. WCLIB (GR) - WCLB Standard Grading Rules for West Coast & Imported Softwood Lumber No.18; 2024.
J. WWPA G-5 - Western Lumber Grading Rules; 2025.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide technical data on wood preservative materials and application instructions.

C. Samples: For rough carpentry members exposed to view, submit two samples, ____ by ____ inch (____ by ____ mm) in size illustrating wood grain, color, and general appearance.

D. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

E. Submit proposed screw pattern layout for roof sheathing attachment, such that designed roof system meets I-90 Wind Uplift Requirements.

F. Submit data sheets and samples of all fasteners.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Southern Pine, unless otherwise indicated.
   2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
   3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. Northeastern Lumber Manufacturer's Association (NeLMA).
   2. National Lumber Grades Authority (NLGA).
   3. Redwood Inspection Service (RIS).
   4. Southern Pine Inspection Bureau (SPIB).
   5. West Coast Lumber Inspection Bureau (WCLIB).
   6. Western Wood Products Association (WWPA).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Roof Sleepers (1 by 4 inches).
   1. Species: Spruce-pine-fir (south) or Spruce-pine-fir.
   2. Grade: Construction or No. 2.
   3. Extent: Roof "Sleepers", and elsewhere as required or indicated.

E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 EXPOSED BOARDS

A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.

B. Moisture Content: Kiln-dry (15 percent maximum).

C. Surfacing: S4S.

D. Species: Southern Pine.

E. Grade: No. 2, 2 Common, or Construction.

2.04 CONSTRUCTION PANELS

A. Roof Sheathing: APA RATED SHEATHING, Veneer Core Plywood; Tongue and Groove Edges, and as follows:
   1. Exposure Durability Classification: Exterior.
   2. Span Rating: As required to suit rafter spacing indicated.
      a. 42/20 minimum, unless otherwise indicated.
   3. Thickness: 3/4-inch.

B. Communications and Electrical Room Mounting Boards: UL verified fire retardant backboard; A-C plywood; 3/4 inch (19 mm) thick; Coated with UL Classified Fire Retardant Latex (Class "A" Rated). Tested to UL723 (ASTM E84) standards. Color: As selected by Architect from manufacturer's standard colors.
   1. Manufacturers/Products:
      a. WoodBacker "Fire Retardant Backboards"; [Basis of Design]: www.woodbacker.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

C. Other Applications:
   1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
   2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
   3. Other Locations: PS 1, C-D Plugged or better.

2.05 ACCESSORIES

A. Metal and Finish of Fasteners:
   1. Untreated Wood: Unfinished steel.

B. Fasteners and Anchors:
   1. Metal and Finish: AISI Type 304 or 316 stainless steel for fire-retardant wood and preservative-treated wood locations; hot-dipped galvanized steel per ASTM A153/A153M for rough carpentry exposed to weather, in ground contact, or area of high relative humidity; unfinished steel elsewhere. Acceptable to manufacturer of wood treatment materials and manufacturers of fasteners.
   2. Anchors: Toggle bolt type for anchorage to hollow masonry.

C. Metal Framing Anchors:
   1. General: Provide metal framing anchors of type, size, metal, and finish indicated that comply with requirements specified including the following:
      a. Current Evaluation/Research Reports: Provide products for which model code evaluation/research reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with the building code in effect for this Project.
      b. Allowable Design Loads: Provide products for which manufacturer publishes allowable design loads that are determined from empirical data or by rational engineering analysis and that are demonstrated by comprehensive testing performed by a qualified independent testing laboratory.
   2. Galvanized Steel Sheet: Steel sheet zinc-coated by hot-dip process on continuous lines prior to fabrication to comply with ASTM A 525 for Coating Designation G90 and with ASTM A 446, Grade A (structural quality); ASTM A 526 (commercial quality); or ASTM A 527 (lock-forming quality); as standard with manufacturer for type of anchor indicated.
      a. Use galvanized steel framing anchors for rough carpentry exposed to weather, in ground contact, or in area of high relative humidity, and all other locations, and at every point of bearing.
      b. Minimum Thickness: 18-gauge.

D. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.

1. For contact with preservative treated wood in exposed locations, provide minimum G185 (Z550) galvanizing complying with ASTM A653/A653M.

E. Nails, Wire, and Brads: FS FF-N-105.

F. Power Driven Fasteners (screws): National Evaluation Report NER-272.

G. Wood Screws: ANSI B18.6.1.

H. Lag Bolts: ANSI B18.2.1.

I. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and where indicated, flat washers.

2.06 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifyiing level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
   1. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum fllame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Do not use treated wood in direct contact with the ground.
   2. Interior Type: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Interior rough carpentry items are to be fire retardant treated.
      c. All concealed wood blocking, framing and sheathing in buildings of Type I or Type II construction shall be fire retardant treated.
      d. Review Life Safety Sheets and provide fire retardant treated wood blocking in all rated walls.
      e. Do not use treated wood in applications exposed to weather or where the wood may become wet.

2.07 ENGINEERED WOOD PRODUCTS

A. General: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that evidence compliance with building code in effect for Project.
   1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide nonstructural framing and blocking to support the following:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Chalkboards and marker boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.
   10. Other wall- or ceiling-mounted items indicated on drawings.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at each roof opening except where prefabricated curbs are specified and where specifically indicated otherwise; form corners by alternating lapping side members.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
   1. Screw panels to framing; staples are not permitted.

B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.

2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.
4. Size and Location: As indicated on drawings.

3.06 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) from true position, maximum.

B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.07 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 5000.
1. Comply with applicable regulations.
2. Do not burn scrap on project site.
3. Do not burn scraps that have been pressure treated.
4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 2000
FINISH CARPENTRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Shop finishing.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 06 1000 - Rough Carpentry.

C. Section 06 4000 - Architectural Woodwork: Wood frames, countertops, etc.

D. Section 08 1416 - Flush Wood Doors.

E. Section 09 9100 - Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

C. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2024.

D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide instructions for attachment hardware.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.

D. Samples: Submit one sample of lumber or finish plywood, 12 by 12 inch (____by____ mm) in size, and two samples 3 by 3 inch in size, illustrating wood grain and specified finish.

E. Samples: Submit two samples of wood trim 6 inch (____ mm) long.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with AWI Architectural Woodwork Quality Standards Illustrated, Premium grade.

B. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire retardant requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect from moisture damage.

1.08 PROJECT CONDITIONS

A. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

B. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

PART 2 - PRODUCTS

2.01 MATERIALS - GENERAL

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Quality Standards Illustrated for Premium Grade.

2.02 SUSTAINABILITY CHARACTERISTICS

2.03 LUMBER MATERIALS

A. Softwood Lumber: SYP species, maximum moisture content of 6 percentof quality suitable for transparent finish.

B. Hardwood Lumber: white or yellow poplar species (coordinate with other wood trim), maximum moisture content of 6 percent.

2.04 SHEET MATERIALS

A. Softwood Plywood: PS 1 Grade A-B; Veneer core; SYP face species, (or similar species permitted by reference standards).

B. Hardwood Plywood: HPVA HP-1, Grade AA, Type I at exterior, Type II at Interior; Veneer core, type of glue recommended for application; Natural Birch face species, Rotary cut.

2.05 PLASTIC LAMINATE MATERIALS

A. Plastic Laminate: NEMA LD 3, HGS; color as selected; finish as selected.

2.06 ADHESIVE

A. Laminate Adhesive: Type recommended by laminate manufacturer to suit application; not containing formaldehyde or other volatile organic compounds.

2.07 FASTENINGS

A. Fasteners: Of size and type to suit application; galvanized finish in concealed locations and stainless steel finish in exposed locations.

B. Concealed Joint Fasteners: Threaded steel.

2.08 ACCESSORIES

A. Lumber for Shimming, Blocking: Softwood lumber of SYP species.

B. Primer: Alkyd primer sealer.

C. Wood Filler: Solvent base, tinted to match surface finish color.

2.09 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Cap exposed plastic laminate finish edges with material of same finish and pattern.

C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

D. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)

2.10 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

1. Transparent:
   a. System - 1, Lacquer, Nitrocellulose.
   b. Stain: As selected by Architect.
   c. Sheen: Flat.
2. Opaque:
   a. System - 1, Lacquer, Nitrocellulose.
   b. Color: As selected by Architect.
   c. Sheen: Flat.

E. Prime paint surfaces in contact with cementitious materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify wall surface is free of bows, humps, and other deficiencies that will be emphasized by the trim work. Report these issues to the Prime Contractor.

3.02 INSTALLATION

A. Set and secure materials and components in place, plumb and level.

B. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.

C. Install interior trim with wall adhesive by gun application. Install exterior trim and components with hot-dipped galvanized or stainless steel nails at 12" o.c., unless recommended otherwise by manufacturer.

D. Match grains and color so that individual pieces do not stand out.

3.03 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 09 9100 - Painting.

C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.04 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch (1.6 mm).

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

END OF SECTION

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SECTION 06 4000
ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Laminate clad countertops.

B. Laminate covered cabinets.

C. Wood cabinets, desks, and paneling.

D. Solid surface countertops, backsplashes and trim, where indicated; and vertical panels, where indicated.

E. Manufactured quartz solid surface countertop, backsplashes and trim, where indicated; and vertical panels, where indicated.

F. Closet and utility shelving (paint on site, under Section 09 9100).

G. Wood frames, sidelights, panels, base, window sills, and miscellaneous trim (paint on site, under Section 09 9100), stained (transparent finish) or painted (opaque finish) where indicated.

H. Hardware for architectural woodwork.

I. Related work and trim for above items.

J. Extent of each type of architectural woodwork is indicated on drawings and in schedules.

K. Architectural woodwork and components for opaque finish are intended to be finish painted on-site, under Section 09 9100.

L. Architectural woodwork and components for natural, stained and/or transparent finish are intended to be painted in woodwork fabricator's shop under controlled conditions, under the work of this Section.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Related work specified elsewhere includes:
   1. Section 06 1000 - Rough Carpentry.
   2. Section 06 2000 - Finish Carpentry.
   3. Section 07 9005 - Joint Sealers.
   4. Section 08 1416 - Flush Wood Doors.
   5. Section 09 9100 - Painting.
   6. Section 12 3219 - Laminate Casework.

1.03 SUBMITTALS:

A. Shop Drawings: Submit shop drawings showing location of each item, dimensioned plans and elevations, large scale details, attachment devices, blocking requirements and other components.
   1. Manufacturer's current and complete product data, for manufactured units of work, including color selection data, samples, and anchorage systems.

B. Samples: Submit the following samples:
   1. Lumber and panel products with or for transparent finish; 6-inches x 3/4-inch x 18-inches, for each species and cut, finished on 1-side and 1-edge. Also submit two 3 by 3 inch samples with finish on 1-side.
   2. Cabinet Hardware: One unit of each type and finish, which will be returned for use on the project, upon request by the Contractor.
   3. Quartz Solid Surface: Manufacturer's standard samples, approximately 6-inches x 6-inches with finish as required for this project, and representative color range anticipated.

4. Solid Surfacing and Plastic Laminate Products: Manufacturer's standard samples, approximately 4-inches x 6-inches, with finish as required for this project, and representative color range anticipated.

1.04 QUALITY ASSURANCE:

A. AWS: Comply with applicable requirements of "Architectural Woodwork Standards" published by the Architectural Woodwork Standards, 2nd Edition, October, 2014.

B. Fabricator Qualifications: Fabricators shall be experienced firms specializing in the types of architectural woodwork required for this project for at least 5-verifiable years and on at least 10-verifiable projects of similar size, scope, complexity, and quality as this project.
   1. Quartz Fabricator: 5-years and 10-verifiable projects.
   2. Solid Surfacing Fabricator: 5-years and 10-verifiable projects.

C. Installer Qualifications: Arrange for installation of architectural woodwork by the fabricator, or by a firm under the control and direction of the fabricator, which can demonstrate at least 5-verifiable years successful experience in installing architectural woodwork items on at least 5-verifiable projects, similar in type and quality to those required for this project.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Protect woodwork during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

B. Do not deliver woodwork, until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, woodwork must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

1.06 PROJECT CONDITIONS:

A. Conditioning: Woodwork Manufacturer and Installer shall advise Contractor of temperature and humidity requirements for woodwork installation and storage areas. Do not install woodwork until required temperature and relative humidity have been stabilized and will be maintained in installation areas.

B. Maintain temperature and humidity in installation area as required to maintain moisture content of installed woodwork within a 1.0-percent tolerance of optimum moisture content, from date of installation through remainder of construction period. Require Woodwork Manufacturer to establish optimum moisture content and required temperature and humidity conditions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Laminate Clad and Wood Cabinet Manufacturers: Subject to compliance with requirements, provide premium grade, custom made cabinets and woodwork from a millwork shop complying with requirements of "Quality Assurance" article above.

B. Plastic Laminate Manufacturer: See Finish Legend for Manufacturers and colors.

C. Solid-Surfacing Material/Manufacturer: Homogeneous solid sheets of cast, filled acrylic resin complying with material and performance requirements in ANSI Z124.3, for Type 6.
   1. See Finish Legend for Manufacturers and colors.

2.02 FABRICATION, GENERAL:

A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber at time of fabrication and for relative humidity conditions in the installation areas.

B. Fabricate woodwork to dimensions, profiles, and details indicated with dowel, dado, glue and screw construction, with openings and mortises precut, where possible, to receive hardware and other items and work.

1. Ease edges to a 1/16-inch radius, for corners of cabinets and edges of solid wood (lumber) members less than 1-inch in nominal thickness, 1/8-inch radius for edges of rails and similar members over 1-inch in nominal thickness.

C. Complete fabrication, assembly, hardware application, and other work before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Pre-Cut Openings: Fabricate architectural woodwork with pre-cut openings, where possible, to receive hardware, appliances, plumbing fixtures, electrical work and similar items. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape. Smooth edges of cutoffs and, where located in countertops and similar exposures seal edges of cutouts with a water-resistant coating.

E. Measurements: Before proceeding with fabrication of woodwork required to be fitted to other construction, obtain field measurements and verify dimensions and shop drawing details as required for accurate fit. A tight fit of less than 1/8-inch is expected.

F. Products in this Section shall be constructed only of materials that are formaldehyde-free.

2.03 FIRE-RETARDANT MATERIALS:

A. Where fire-retardant treated lumber is indicated, provide materials which are pressure impregnated with fire-retardant chemicals and comply with the following requirements:
   1. As required to comply with referenced standards and finish classifications necessary as per the Standard Building Code, NFPA 101 - Life Safety Code, authorities having jurisdiction, and acceptable in all respects for indoor use and finish requirements.
   2. Fire-Retardant Chemicals: Use chemicals of type and for applications indicated which do not bleed-through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated lumber from untreated lumber.

B. Fire Performance Characteristics: Provide materials which are identical to those tested per ASTM methods and time periods indicated, are marked and listed for fire performance characteristics by Underwriters Laboratories, Inc., or other testing and inspecting agency acceptable to authorities having jurisdiction, and comply with the following requirements:
   1. Mill lumber after treatment, within limits set for wood removal which does not affect listed fire performance characteristics, using a woodworking plant certified by testing and inspecting agency.

C. Marking: Identify treated lumber with separable paper classification marking of inspecting and testing agency, unless otherwise indicated.

D. Surface Burning Characteristics: Not exceeding values required by latest edition of the "Standard Building Code" and "NFPA 101" (with amendments), tested per ASTM E 84 for standard time period.
   1. Flame Spread: Per Code.
   2. Smoke Developed: Per Code.

E. Kiln-dry woodwork after treatment to levels required for non-fire-retardant treated woodwork materials. Maintain moisture content required by kiln drying, before and after treatment.
   1. Discard treated lumber which does not comply with requirements of referenced woodworking standard. Do not use twisted, warped, bowed, discolored, or otherwise damaged or defective lumber.

2.04 STANDING AND RUNNING TRIM:

A. Quality Standard: Comply with AWS Section 6 - Interior Millwork.

B. Rout or groove backs of flat trim members, kerf backs of other wide flat members, except for members with ends exposed in finished work.

C. Assemble Casings in plant except where limitations of access to place of installation require field assembly.

D. Interior Trim for Transparent Finish (typical finish unless specifically indicated otherwise): Comply with the following requirements:
   1. Grade: Premium, Grade I.
   2. Lumber Species: Match wood doors.
   3. Cut: Plain Sliced.
   4. Locations: Provide stained transparent finish within rooms which have new woodwork with transparent finish, at indicated areas. Refer to Elevations.

E. Interior Trim for Opaque Finish (only where specifically indicated, if any): Comply with the following requirements:
   1. Grade: Custom. Grade II.
   2. Lumber Species: Any closed-grain hardwood listed in referenced woodworking standard.
   3. Cut: Plain or Rotary cut.
   4. Locations: Provide opaque finish within rooms which have new woodwork with opaque finish, unless indicated otherwise. Refer to Elevations and Finish Legend.

2.05 ARCHITECTURAL COUNTER TOPS:

A. Quality Standard: Comply with AWS, Edition 1 - Section 11-Countertops.

B. Type of Top - Laminate Clad:
   1. Grade: Premium; Grade I.
   2. Edge Treatment: Refer to Drawings.
   3. Core: Minimum 47-lb. density particle board, except at least 3/4-inch A-B plywood with exterior glue (approved for interior use), at tops with sinks and/or plumbing fixtures.
   4. Minimum Thickness: 1-1/4-inches at tops and 3/4-inch at splashes, unless indicated otherwise on the Drawings.

C. Types of Top (and/or panel): Solid Surfacing.
   1. Colors, Patterns and Finishes: As indicated, or if not indicated, as selected from any of manufacturer's standard finishes and colors.
   2. Edge Treatment: As indicated on the Drawings.
   3. Thickness - Tops and Substrates:
      a. Tops (and any flat vertical panels): 3/4-inch, with 1-1/4-inch built-up edges unless indicated otherwise on the Drawings.
      b. Backsplash: 1/2-inch.
      c. Edge Treatment: As indicated on the Drawings, or if not indicated, ease all exposed edges to 1/16" radius, and seam width of less than 1/8".
         1) Manufacturer-approved adhesive to create color-matched seam.
      d. Substrates: Refer to the Drawings for thickness of plywood below solid surface tops, splashes, etc., or if not indicated, at least 3/4-inch thick at horizontal and sloped surfaces (and at least 1/2-inch thick at any vertical panels).
   4. Allowable tolerances:
      a. Flat and true to within 1/8" of a flat surface over a 10' length.
      b. Allow a minimum of 1/16" to a maximum of 1/8" clearance between surface and each wall.
      c. Variation in Component Size: 1/8" over a 10' length.
      d. Location of Openngs: 1/8" from indicated location.
   5. Provide manufacturer's 10-year warranty against defects in materials.
      a. Warranty shall provide material to repair or replace defective materials.
      b. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.
      c. The above warranty shall be in addition to, shall be in effect simultaneously with, and shall not limit or alter other project or product warranties or guarantees, nor shall it serve as limitation to other remedies available to the Owner.

2.06 FINISHING OF INTERIOR ARCHITECTURAL WOODWORK:

A. Quality Standard: Comply with AWS Section 5, unless otherwise indicated.

B. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing of concealed surfaces and similar preparations for finishing of architectural woodwork, as applicable to each unit of work.

C. Interiors for wood cabinets: To match wood veneer.

D. Melamine cladded interiors for wood cabinets: To match HPDL.

2.07 ARCHITECTURAL WOOD VENEER CABINETS:

A. Quality Standard:
   1. Comply with AWS Section 10.
   2. Grade: Premium.
   3. Design: Flush Overlay - Type A- Frameless construction.

B. Wood Veneer Cladding: As follows:
   1. Grade; Premium, Grade I.
   2. Lumber Species: Select White Birch, unless scheduled otherwise.
   3. Cut: Plain sliced.

C. Hardboard: AHA A135.4 (tempered).

D. Core Materials:
   1. MR Moisture Resistant Medium Density Fiberboard: Average 47-pound density grade, ANSI A208.2.
   2. Grade AB Plywood.

2.08 ARCHITECTURAL LAMINATE CLAD CABINETS:

A. Quality Standard:
   1. Comply with AWS Section 10.
   2. Grade: Premium.
   3. Design: Flush overlay - Type A- Frameless construction.

B. Laminate Cladding: High pressure decorative laminate complying with NEMA LD 3 and as follows:
   1. Colors, Patterns and Finishes: As indicated or, if not otherwise indicated, as selected by Architect from laminate manufacturers' standard products in the following categories: Solid, stippled, textured, wood grain and/or patterned colors; Thru-color type.
   2. Provide specific types as scheduled.
      a. Horizontal Surfaces: HGS, 0.048 inch (1.22 mm) nominal thickness, through color, colors as scheduled, finish as scheduled.
      b. Vertical Surfaces: VGS, 0.028 inch (0.71 mm) nominal thickness, through color, colors as scheduled, finish as scheduled.
      c. Post-Formed Horizontal Surfaces: HGP, 0.039 inch (1.0 mm) nominal thickness, through color, colors as scheduled, finish as scheduled.
      d. Post-Formed Vertical Surfaces: VGP, 0.028 inch (0.71 mm) nominal thickness, through color, colors as scheduled, finish as scheduled.
      e. Flame Retardant Surfaces: HGF, 0.048 inch (1.22 mm) nominal thickness, through color, colors as scheduled, finish as scheduled.
      f. Cabinet Liner: CLS, 0.020 inch (0.51 mm) nominal thickness, through color, colors as scheduled, finish as scheduled.
      g. Laminate Backer: BKL, 0.020 inch (0.51 mm) nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

C. Hardboard: AHA A135.4 (tempered).

D. Melamine cladded interiors in laminate cabinets.

E. Core Materials:
   1. MR Moisture Resistant Medium Density Fiberboard: Average 47-pound density grade, ANSI A208.2.

2.09 INTERIOR FRAMES AND JAMBS

A. Quality Standard: Comply with AWS Section 10.
   1. Grade: Premium.

B. Wood Species:
   1. For Opaque Finish: Any closed-grain hardwood listed in referenced woodworking standard.
   2. For Transparent Finish (stained): Match wood doors.

C. Fire Rated Frames:
   1. 20 min and 45 min rated types. Refer to Door Schedule.

D. Jamb Type: Flat jamb, unless indicated otherwise.

2.10 CLOSET AND UTILITY SHELVING:

A. Plastic laminate shelving where indicated.

B. Quality Standard: Comply with AWS Section 6.

C. Shelving for Opaque Finish: Comply with the following requirements:
   1. Grade: Custom.
   2. Shelving Material: Birch faced veneer core plywood.
   3. Exposed Edging: Solid hardwood.
   4. Thickness: 1-inch at wood shelves, unless indicated otherwise

D. Shelving for Transparent Finish: Comply with the following requirements:
   1. Location: Only in rooms where specifically indicated on Drawings.
   2. Grade: Custom.
   3. Species: AWS Veneer Grade A, Select Red Oak, or White or Yellow Poplar, Rotary Cut (unless scheduled otherwise).
   4. Thickness (plywood): 1-inch (minimum), with solid wood nosing.
   5. Lumber for shelving, only where indicated on the Drawings: 5/4-inch with nosings as indicated.

2.11 FASTENERS AND ANCHORS:

A. Screws: Select material, type, size and finish required for each use. Comply with FS FF-S-111 for applicable requirements.

B. Nails: Select material, type, size and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

C. Anchors: Select material, type, size and finish required by each substrate for secure anchorage. Provide non-ferrous metal or hot- dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion-resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

2.12 CABINET HARDWARE AND ACCESSORY MATERIALS:

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items which are specified in Section 08 7100 - Finish Hardware.

B. Hardware Standard: Comply with ANSI/BHMA A156.9 "American National Standard for Cabinet Hardware" for items indicated by reference to BHMA numbers or referenced to this standard.

C. Hardware Finishes: Comply with BHMA 1301 for finishes indicated by BHMA Code Numbers or if not otherwise indicated, provide finishes complying with requirements indicated.

1. For exposed hardware comply with requirements indicated for finish and base indicated at the end of this Section.
2. For concealed hardware provide manufacturer's standard finishes which comply with product class requirements of ANSI/BHMA A156.9, and which match exposed hardware on same cabinet unit.

2.13 SHELVING SUPPORTS AND RODS

A. Wall Mounted Brackets and Standards:
   1. Adjustable, double slotted, extra-heavy duty:
      a. Equivalent to K&V No. 85/185 Series Extra Duty Standards & Brackets.
         1) Standards: 1-1/4" wide x 1/2" deep x length indicated. 16 ga. steel. Finish & Color: TBS.
         2) Brackets: Vertically adjustable in 1" increments. 14 ga. & 16 ga. steel. Finish & Color: TBS.
   2. Clothes Rods:
      a. Closet Hanger Rod and Support:
         1) Rod: Equivalent to K&V No. 770-1. Extra-Duty. Steel. Chrome double-plated finish. Provide with end caps.
         2) Flanges: Equivalent to K&V No. 734 and No. 735, two (2) each per rod. Zinc cast. Finish: Match rod.
         3) Supports: Fixed closet rod and shelf brackets. Extra-Duty. Equivalent to K&V No. 1198. 10 ga. steel construction. Finish & Color: TBS.

B. Pilaster Standards and Supports: Provide adjustable shelf standards and related supports of type indicated, with matching finish on fasteners and accessories.
   1. Vertical Slotted Standard:
      a. Mortise mounted, 5/8-inch wide x 3/16-inch deep x length indicated; high strength steel.
      b. Equivalent to K&V No. 255, Finish & Color: TBS.
   2. Shelf Support:
      a. Shelf support clip; High strength steel.
      b. Equivalent to K&V No. 256, Finish & Color: TBS.

2.14 COUNTERTOP SUPPORT

A. Countertop support brackets, undercounter support frames, legs and miscellaneous metal parts shall be furniture steel, welded, degreased, cleaned, treated and epoxy powder painted. Color shall be as selected by Architect from manufacturer's standard colors.
   1. Support brackets shall be equal to Rakks EH Counter Support Bracket unless otherwise noted.
      a. For concealed support, provide Inside Wall Flush-Mount bracket.

2.15 CABINET HARDWARE

A. Cabinet Hinges: 170-degrees adjustable "CLIP System" concealed self-closing hinges as manufactured by Julius Blum, Inc., or equivalent by Grass or Stanley.
   1. Finish shall match hardware finish specified in Section 08 7100 - Finish Hardware in room(s) where occurs.

B. Cabinet Hinges: Equivalent to 5-knuckle exposed self-closing hinges as manufactured by Julius Blum, Inc., Grass or Stanley.
   1. Finish shall match hardware finish specified in Section 08 7100 - "Finish Hardware" in room(s) where occurs.

C. Cabinet Door and Drawer Pulls:
   1. Wire pulls, equivalent to Stanley No. 4484, (ANSI B12012), 4-inches long, with 1-inch clearance; unless indicated otherwise. Pull design shall comply with the Americans with Disability Act (ADA).
      a. Finish shall match hardware finish specified in Section 08 7100 - Finish Hardware.

D. Cabinet Door Catches: Manufacturer's standard 2-screw sill mounted unit made of molded nylon, lipped over sill to form bumper and hold in place, with 2-screw mounted heavy door mounted unit with nylon roller; provide spring-mounted units where required.
   1. Acceptable Manufacturers: Any of manufacturers listed for other cabinet hardware.

E. Cabinet Drawer Slides: Heavy Duty, non-corrosive (galvanized) full extension ball bearing slides rated at 100-pounds, with positive stop, and self-closing and lift-out disconnect features; Model No. 1429, as manufactured by Knape & Vogt, or equivalent by Blum or Grant.
   1. At legal size drawers, use K&V No. 1483 or equivalent, rated at 150-pounds, with same features as noted above.

F. Cabinet Shelf Standards: Manufacturer's standard steel units with anchors and supports 5/8-inch wide x 3/16-inch high, adjustable on 1/2-inch centers; Series 255, as manufactured by K&V, or equivalent by Grant or Stanley.
   1. Wood Cabinets: Model No. 255 BRN with No. 256 BRN supports and matching fasteners.
   2. Omit standards where fixed shelves are indicated.
   3. All standards to be recess mounted (flush in routed dados), unless specifically indicated otherwise.

G. Cabinet Locks: Where indicated on the Drawings, provide cabinet manufacturer's standard 5-disc tumbler, cam type, keyed differently at each room , with metal strike screwed to wood surface, and master keyed.
   1. Furnish 2-keys for each lock.
   2. Furnish 5-master keys
   3. Finish to match Section 08 7100 - Finish Hardware finish in room(s) where occurs.
   4. Location: Where indicated.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.

B. Pre-Installation Meeting: Meet at project site prior to delivery of architectural woodwork and review coordination and environmental controls required for proper installation and ambient conditioning in areas to receive work. Include in meeting the Contractor; Architect and other Owner Representatives (if any); Installers of architectural woodwork, wet work such as plastering, other finishes, painting, mechanical work and electrical work; and firms or persons responsible for continued operation (whether temporary or permanent) of HVAC system as required to maintain temperature and humidity conditions. Proceed with woodwork installation only when everyone concerned agrees that required ambient conditions can be maintained.

C. Deliver concrete inserts and similar anchoring devices to be built into substrates, well in advance of time substrates are to be built.
   1. Coordinate location and placement of concealed treated blocking (by others) prior to finish materials installations.

D. Prior to installation of architectural woodwork, examine shop fabricated work for completion, and complete work as required, including back priming and removal of packing.

3.02 INSTALLATION:

A. Quality Standard: Install woodwork to comply with AWS Section 2, 6, 10, 11 for the same grade specified in Part 2 of this Section for type of woodwork involved.

B. Install woodwork plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8-inch in 8'-0" for plumb and level (including tops); and with no variations in flushness of adjoining surfaces.

C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.
   1. Seal all hardware cuts, routed slots, etc., before installation of hardware.

D. Anchor woodwork to anchors or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fasteners heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork, and matching final finish where transparent finish is indicated.

E. Standing and Running Trim, and Sills: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns, miter at corners and comply with referenced Quality Standards for joinery.

F. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated. Maintain veneer sequence matching (if any) of cabinets with transparent finish.
   1. Install cabinets with no more than 1/8-inch in 96-inches sag, bow, or other variation from a straight line.

G. Wood Storage Shelving: Complete the assembly of units and install in the areas indicated, including hardware and accessories as indicated.

H. Tops: Anchor securely to base units and other support systems indicated. Caulk space between backsplash and wall with specified sealant.
   1. Install countertops with no more than 1/8-inch in 96-inches sag, bow, or other variation from a straight line.

I. Wood Panels: Anchor panels to supporting substrate with concealed panel-hanger clips and by blind nailing on backup strips, splined-connection strips, and similar associated trim and framing. Do not face nail unless otherwise indicated.
   1. Install flush panels with no more than 1/16-inch in 96-inches vertical cup or bow and 1/8-inch in 96-inches horizontal variation from a true plane.

J. Install shelf brackets according to manufacturer's written instructions, spaced not more than 32 inches o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

K. Install standards for adjustable shelf supports according to manufacturer's written instructions. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Space fasteners not more than 12 inches o.c.

L. Install standards for adjustable shelf brackets according to manufacturer's written instructions, spaced not more than 36 inches o.c. and within 6 inches of ends of shelves. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

M. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled. Install shelves, fully seated on brackets, and supports.
   1. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.

N. Install rod flanges for rods as indicated. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Install rods in rod flanges.

O. Refer to Section 09 9100 - Painting, for final finishing of installed architectural woodwork which is indicated to be painted on-site.

3.03 ADJUSTMENT, CLEANING, FINISHING, AND PROTECTION:

A. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch-up shop-applied finishes to restore damaged or soiled areas.

D. Complete the finishing work specified as work of this section, to whatever extent not completed at shop or prior to installation of woodwork.

E. Provide final protection and maintain conditions, in a manner acceptable to Fabricator and Installer, which ensures architectural woodwork being without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 07 1400
FLUID-APPLIED AIR BARRIER

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sealants for substrates of fluid-applied air barrier.

B. Other Accessories.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 04 2000 - Unit Masonry: Masonry joints prepared to receive flashings.

C. Section 07 1300 - Sheet Waterproofing: Sheet membrane waterproofing for below grade slab and walls.

D. Section 07 9005 - Joint Sealers: Sealant for joints other than substrates for air barrier in this Section.

E. Section 09 2116 - Gypsum Board Assemblies: Exterior sheathing receiving fluid-applied air barrier.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM C836/C836M - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course; 2018 (Reapproved 2022).

C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

D. ASTM E 2178 Standard Test Method for Air Permeance of Building Materials.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for air barrier system(s) specified.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures and acceptable installation temperatures.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Membrane Manufacturer Qualifications: Company specializing in fluid-applied air barrier membranes with ten years experience.

B. Installer Qualifications: Company specializing in installation of fluid-applied air barrier with minimum five years documented experience.

C. Mock-Up: Include Fluid-Applied Air Barrier in Mock-Up as described in Section 01 4000 - Quality Requirements.

D. Comply with ALL special requirements and inspections of air barrier system manufacturer, as required to obtain the required 5-year labor and materials warranty.

E. Single-Source Responsibility: Obtain primary air barrier materials of each type required from a single manufacturer.

F. Sealant for Substrate Surfaces: Sealant shall be manufactured by same manufacturer as fluid-applied air barrier.

1.06 FIELD CONDITIONS

A. Maintain range of ambient and substrate temperatures recommended by air barrier manufacturer. Do not apply product to wet substrate or during snow, rain, fog, or mist.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five (5) year manufacturer warranty for air barrier failing to resist penetration of water , except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Fluid-Applied Waterproofing Vapor Permeable Air Infiltration Barrier System (for CMU, Sheathing, and as indicated):
   1. GE "Elemax 2600 AWB" 100% Silicone Air and Water-Resistive Barrier system; [Basis of Design]: www.siliconeforbuilding.com/AWB/.
   2. Dow Corning "DefendAir 200" Silicone Liquid Applied Air & Weather Barrier: www.dowcorning.com.
   3. Pecora "XL-Perm Ultra VP" Air, Vapor & Water Barrier System: www.pecora.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FLUID-APPLIED WATERPROOFING MATERIALS

A. Fluid-Applied Air Barrier - General: Cold-applied elastomeric fluid-applied membrane.
   1. General: Provide fluid-applied air barrier system that is watertight and complies with performance requirements specified, as demonstrated by testing performed by a nationally recognized independent testing laboratory of manufacturer's standard systems according to test methods indicated.
   2. Fluid-applied air barrier system shall be compatible with specified substrate.

B. Liquid Air Infiltration Barrier, Vapor Permeable, Cold-Applied Elastomeric Membrane:, complying with ASTM C 836, one component. (For CMU, Sheathing, and as indicated).
   1. Cured Thickness: Comply with manufacturer's recommendation to meet performance specified.
   2. Suitable for installation over concrete, and sheathing substrates.
   3. UV Resistant.
   4. Membrane Air Permeance ASTM E2178: Not to exceed 0.004 cfm/sq. ft. of surface area (at specified thickness) at test pressure of 0.3 in. water (75 Pa) on CMU block.
   5. Membrane Vapor Transmission per ASTM E96, Method B: Not less than 10 perms.
   6. Product shall withstand weather exposure up to 6 months.

C. Flexible Flashings: Type recommended by membrane manufacturer.

2.03 ACCESSORIES

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Joint Reinforcing/Transition Strip: 2" wide glass fiber tape, self-adhesive polymeric air/vapor barrier membrane (30 mil minimum), or other material applicable for application, which is approved by air barrier manufacturer.

C. Surface Conditioner: Compatible with membrane compound; as recommended by membrane manufacturer.

D. Sealant for Substrate Surfaces: As recommended by membrane manufacturer.

E. Liquid Membrane for details and terminations: As recommended by membrane manufacturer.

F. Detail Membrane: Flexible, fully-adhered membrane for detail flashing areas: As recommended by membrane manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter, including efflorescence, detrimental to adhesion or application of air barrier system.

C. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of air barrier materials.

D. Verify that items that penetrate surfaces to receive air barrier are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive air barrier.

B. Do not apply air barrier to surfaces unacceptable to manufacturer.

C. Caulk sheathing joints prior to application of water/air barrier coating. Caulk with manufacturer-recommended joint sealant reinforced with fiberglass mesh tape encapsulated in sealant. Encapsulate fastener heads with manufacturer-recommended sealant. Fiberglass reinforcement is not required for sheathing fastener heads.
   1. Verify that Fluid-Applied air barrier is compatible with sealant used.

D. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

E. All surfaces must be sound and free from spalled areas, loose aggregate, loose nails or screws, sharp protrusions or other matter that will hinder the adhesion or regularity of the membrane installation. The surface must also be free from frost, dirt, grease, oil or other contaminants. Clean loose dust and dirt from the surface by brushing or wiping with a clean, dry cloth.

F. Concrete and other monolithic cementitious surfaces: Pretreat surface irregularities and large voids with liquid membrane, or repair with lean mortar mix or nonshrinking grout.

G. CMU surfaces: Strike joints full and flush to face of concrete block. Ensure surface is smooth and free from projections. Fill voids and holes with lean mortar mix or nonshrinking grout.

H. Sheathing panels: Fasten corners and edges with appropriate screws. Drive fasteners flush with panel surface (not countersunk). Tape panel butt joints with 2 in. wide sheathing tape recommended by manufacturer.

I. Complete detailing prior to applying air barrier.

J. Fill and seal cracks and joints between exterior sheathing panels or adjacent substrates, or in masonry, with trowel application of air barrier product and reinforce with strip of 2" (minimum) wide glass fiber tape. Follow manufacturer's instructions if other joint treatment is recommended. Allow recommended cure time before proceeding.

K. Proceed with applying air barrier only after substrate cleaning, sealing, and other preparation and sealing of joints and penetrations have been completed.

3.03 INSTALLATION

A. Apply air barrier in accordance with manufacturer's instructions .

B. Apply surface conditioner (if required) at a rate recommended by manufacturer. Protect conditioner from rain or frost until dry.

C. Apply by spray a complete and continuous unbroken film of liquid air and water barrier membrane.

D. Apply air barrier in accordance with manufacturer's instructions to uniform wet film thickness in order to dry to thickness recommended by manufacturer to achieve performance specified.
   1. Apply more than one coat, if recommended by manufacturer.

E. Roll the air barrier after spray application to fill all pin holes.

F. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

G. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Owner will provide testing services, and Contractor to provide temporary construction and materials for testing.

C. Provide daily on-site attendance of waterproofing and insulation manufacturer's representative during installation of this work.

3.05 CLEANING AND PROTECTION

A. Do not inhibit damp substrate from drying out. Do not expose the backside of the substrate to moisture or rain.

B. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

C. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 180 days.

D. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construcion.

E. Remove masking materials after installation.

SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at cavity wall construction.

B. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

C. Batt insulation above-ceiling construction, with vapor barrier, where indicated.

D. Batt insulation in walls where indicated.

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry Assemblies: Cavity walls for board insulation.

B. Section 07 2216 - Roof Board Insulation (Nail Base).

1.03 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

D. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2026.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.05 MOCK-UP

A. Include Thermal Insulation in mock-up as described in Section 01 4000 – Quality Requirements.

1.06 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation Inside Masonry Cavity Walls: Expanded polystyrene (EPS) board.

B. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.

C. Insulation Above Ceilings (where indicated): Batt insulation with no vapor retarder (i.e. unfaced batts) where used with sheet vapor barrier.

2.02 FOAM BOARD INSULATION MATERIALS

A. Expanded Polystyrene (EPS) Board Insulation: Comply with ASTM C578.
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.

B. Extruded Polystyrene (XPS) Board Insulation at masonry cavity walls: Complies with ASTM C578 with either natural skin or cut cell surfaces.
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.

3. Board Size: 48 x 96 inch (1220 x 2440 mm).
4. Board Thickness: 1 inch (25 mm), unless indicated otherwise.
5. Products:
   a. DiversiFoam Products: www.diversifoam.com.
   b. Dow Chemical Company: www.dowbuildingsolutions.com/#sle.
   c. Kingspan Insulation LLC; GreenGuard GG25-LG XPS Insulation Board: www.kingspan.com/#sle.
   d. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

C. Extruded Polystyrene (XPS) Cavity Wall Insulation Board: Comply with ASTM C578, and manufactured using carbon black technology.
1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
3. Type and Thermal Resistance, R-value (RSI-value): Type IV, 5.6 (0.98), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.
4. Board Size: 15-3/4 inch by 96 inch (400 mm by 2440 mm).
5. Board Thickness: 1-3/4 inch (44.5 mm).
6. Board Edges: Square.

2.03 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
4. Formaldehyde Content: Zero.
5. Thickness: As required to meet the following requirements:
   a. Roof: R=30.
   b. Exterior walls: R=19.
   c. Interior walls: Thickness of Studs.
6. Facing: Unfaced in interior walls, and where used above ceilings in conjunction with Class A sheet vapor barrier.
7. Products:
   a. CertainTeed Corporation: www.certainteed.com/#sle.
   b. Johns Manville: www.jm.com/#sle.
   c. Knauf Insulation: www.knaufinsulation.com.
   d. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

B. Mineral Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
1. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
2. Formaldehyde Content: Zero.
3. Thickness: As required to meet the following requirements:
   a. Roof: R=30.
   b. Exterior walls: R=19.
   c. Interior walls: Thickness of Studs.
4. Facing: Unfaced in interior walls, and where used above ceilings in conjunction with Class A sheet vapor barrier.
5. Products:
   a. Owens Corning: www.owenscorning.com.
   b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

A. Sheet Vapor Barrier: Foil facing comprised of 0.0003"aluminum foil bonded to 30 lb. kraft paper with flame retardant adhesive and reinforced with tri-directional fiberglass scrim, or woven polyethylene film sandwiched between two layers of metalized film. Sheet vapor barrier must meet Class A flame spread classification; with flame spread rating less than 25, and smoke developed rating less than 450, in accordance with ASTM E 84. For substitutions, see Section 01 6000 - Product Requirements.

B. Tape: Polyethylene self-adhering type, 1.75 inch wide minimum.
   1. 3M "Construction Seaming Tape 8087": www:3M.com.
   2. Dow "Weathermate Construction Tape": www.dowbuildingsolutions.com.
   3. Typar "Typar Construction Tape": www.typar.com.

C. Tape: Reinforced foil tape: Type recommended by sheet vapor barrier manufacturer.

D. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

3.02 BOARD INSTALLATION AT CAVITY WALLS

A. Adhere a 6 inches (152 mm) wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.
   1. Tape seal joints between sheets.
   2. Extend sheet full height of joint.

B. Apply adhesive to back of boards:
   1. Three continuous beads per board length.
   2. Apply beads of adhesive oriented vertically so as not to disrupt the drainage plane between the water/air barrier coating and cavity insulation.

C. Install boards to fit snugly between wall ties.

D. Install boards horizontally on walls.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and protrusions.
   4. Tape seal board joints.

E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

F. Place 6 inches (152 mm) wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames, and tape seal in place to ensure continuity of vapor retarder and air seal.

3.03 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

C. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

D. Retain insulation batts under overhead joists/rafters/trusses with sheet vapor barrier under framing members.

E. Install sheet vapor barrier under trusses with foil facing down. Overlap layers as recommended by manufacturer. Attach vapor barrier as recommended by manufacturer. Tape joints with reinforced foil tape recommended by manufacturer.

F. Lay insulation batts over top of sheet vapor barrier.

G. All wet insulation shall be removed and replaced. Provide letter to Architect for record of each occurrence.

H. Visible gaps and voids for insulation on sheet vapor barrier shall be filled.

3.04 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 2216
ROOF BOARD INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Ventilated Nail-Base Insulation Panel System.

1.02 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related work specified elsewhere includes:
   1. Section 05 3100 - "Steel Decking"
   2. Section 07 3113 - “Asphalt Shingles”

1.03 SUBMITTALS:

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of insulation product and accessory specified.

1.04 MOCK-UP

A. Include Roof Board Insulation in mock-up as described in Section 01 4000 - Quality Requirements.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer’s recommendations for handling, storage, and protection during installation.

PART 2 - PRODUCTS

2.01 VENTILATED NAILBASE INSULATION PANELS

A. Ventilated Nailbase Insulation Panel: Venting composite insulation board. Top layer - minimum 5/8-inch 5-ply CDX plywood; Middle layer - 1" wood spacers, or 1" EPS spacers, spaced as recommended by manufacturer. Bottom layer - polyisocyanurate foam insulation. Provide eave / perimeter nailer panels. Minimum LTTR value of R20.5.
   1. Manufacturer/Product:
      a. HunterPanels; "Cool-Vent": www.hunterpanels.com.
      b. Atlas Roofing Corp. "ACFOAM Crossvent Insulation": www.atlasroofing.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FASTENERS

A. Fasteners shall be approved by manufacturer for type of decking used. Fasteners shall be corrosion resistant. Fasteners shall have 3/16-inch shank (unless recommended otherwise by manufacturer), and have oversized heads. Length of fasteners shall be as recommended by panel manufacturer. Fasteners shall penetrate top flute of steel deck minimum of 1 inch. Do not penetrate bottom flute.

2.03 ACCESSORIES:

A. Panel Sheathing Clips: Provide panel sheathing clips in quantity and location recommended by manufacturer. For use at unsupported edges. Simpson Strong-Tie Panel Sheathing Clips PSCA, 20 gauge, galvanized. Substitutions: See Section 01 6000 - Product Requirements.

B. Other Accessories: Provide other installation accessories and materials necessary for proper installation, in compliance with manufacturer’s current written instructions and recommendations.

PART 3 - EXECUTION

3.01 EXAMINATION (NAILBASE INSULATION PANELS)

A. Do not begin installation until structural deck has been properly prepared.

B. Verify deck, adjacent materials, and structural backing is dry and ready to receive insulation.

C. Verify deck surface is flat, free of fins or protrusions and irregularities.

D. If deck preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION (NAILBASE INSULATION PANELS)

A. Install panels with the plywood side face up. Place panels in the manufacturers recommended pattern. Only factory assembled panels will be accepted. Fasten panels through the top nailable surface and also through the wood block panel spacers using manufacturer's approved threaded fasteners.

B. For roof slopes up to 7/12 pitch, 7 inches rise in 12 inches, the minimum number of fasteners shall be 20 per 4 foot by 8 foot panel.

C. For roof slopes over 7/12 pitch, 7 inches rise in 12 inches, the minimum number of fasteners shall be 25 per 4 foot by 8 foot panel.

D. Where unsupported edges of plywood occur, and where partial panels are used, such as at hip and valleys, add additional blocking for support along unsupported edge where needed.

3.03 PROTECTION (NAILBASE INSULATION PANELS)

A. Protect installed products until completion of project.

B. Cover the top and edges of unfinished roof panel work to protect it from the weather and to prevent accumulation of water in the cores of the panels.

C. Do not leave panels exposed to moisture. Wet panels shall be removed or allowed to completely dry prior to application of vapor barrier and/or roof covering.

D. Apply only enough insulation panels per day that can be covered the same day by a completed roof covering material.

END OF SECTION

SECTION 07 3113
ASPHALT SHINGLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible sheet membranes for eave protection, underlayment, and valley protection.

B. Flashing.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Roof sheathing.

B. Section 07 2216 - Roof Board Insulation (Ventilated Nail Base): Ventilated nail-base insulation panels.

C. Section 07 6200 - Sheet Metal Flashing and Trim: Edge and cap flashings.

D. Section 07 7123 - Manufactured Gutters and Downspouts.

1.03 REFERENCE STANDARDS

A. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2025.

B. ASTM D3161/D3161M - Standard Test Method for Wind Resistance of Steep Slope Roofing Products (Fan-Induced Method); 2020 (Reapproved 2025).

C. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement; 2025.

D. ASTM D4869/D4869M - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing; 2016a (Reapproved 2025).

E. ASTM F1667/F1667M - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples; 2021a.

F. NRCA (RM) - The NRCA Roofing Manual; 2025.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating material characteristics, performance criteria, and limitations.

C. Specimen Warranty:
   1. Provide an unexecuted copy of the warranty specified for this Project. Identify the terms and conditions required of the manufacturer along with any and all additionally required riders. Identify the terms and conditions required of the Owner to maintain the warranty.
      a. Submit a letter from the Roofing Contractor to be included in the warranty. This letter shall be signed and dated to indicate the Roofing Contractor has reviewed the roofing system and therefore warrants the system as designed and intended to be warrantied.
      b. Submit a letter from the roofing manufacturer to be included in the warranty. This letter shall be signed and dated by a manufacturer's representative to indicate the manufacturer has reviewed the roofing submittal from the Roofing Contractor and confirms compliance with specifications based on materials supplied in the submittal.

D. Shop Drawings: For shingles, indicate nail pattern layout and starter shingle product, such that designed roof system has wind speed coverage of 120 mph, or that shown on structural drawings.

E. Shop Drawings: For metal flashings, indicate specially configured metal flashings and installation details.

F. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, and setting plan for tapered insulation. Show penetration details, and indicate field-

wrapped flashing. Provide insulation fastening/adhesion patterns for any and all pieces of insulation required for roof system.

G. Samples: Submit two samples of each shingle color indicating color range and finish texture/pattern ; for color selection.

H. Samples: Submit two samples of ridge vent material and each roofing accessory.

I. Samples: Submit data sheets and samples of all fasteners.

J. Manufacturer's Installation Instructions: Indicate installation criteria and procedures.

K. Copies of all roofing submittals and roof warranty information shall be submitted for review and returned Approved prior to pre-roofing conference. These submittals shall be job specific containing project name, location, etc.

L. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer, and are installed in accordance with manufacturer's recommendations, as called for under Field Quality Control article in this Section.

M. Roofing and insulation manufacturers shall submit a letter stating they will provide site inspections that confirm the project is being constructed as specified, by an experienced, full-time employee of the respective manufacturer. This letter shall be submitted with sample warranty submittal.

N. Provide Manufacturer's documentation certifying that the roof design provided complies with the performance requirements for that particular system, as set forth in IBC Chapter 15 in Section 1504. The documentation shall be attached to the roof warranty provided at the close-out of the project.

O. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements for additional provisions.
   2. Extra Shingles: 5% of each type and color.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an Installer (Roofer) to perform roofing work who has not less than five (5) years successful experience in installing roofing systems similar to that required for this Project and who is acceptable to or licensed by the manufacturer of primary roofing materials.
   1. Installer's Field Supervision: Require Installer to maintain a full-time supervisor/foreman who is on job-site during times that roofing work is in progress and who is experienced in installing roofing systems similar to type and scope required for this Project.

B. Manufacturer Qualifications: The manufacturer shall have a minimum of 5 years experience in the manufacture of the roofing system and must also be the original material manufacturer of the primary roofing materials. Provide secondary products as recommended by manufacturer of primary products to use with roofing system specified.

C. Insurance and Code Requirements: Provide materials complying with governing regulations that can be installed to comply with the following:
   1. UL Fire Classified.
   2. Wind Speed Resistance: 120 mph.

D. Insurance Certification: Assist Owner in preparing and submitting roof installation acceptance certification as necessary in connection with fire and extended-coverage insurance on roofing and associated work.

E. UL Listing: Provide roofing system and component materials that have been tested for application and slopes indicated and that are listed by UL for Class A external fire exposure.
   1. Provide roof-covering materials bearing UL Classification Marking on bundle, package, or container indicating that materials have been produced under UL's Classification and Follow-up Service. Submit nailing pattern and size of plates.

F. PRE-ROOFING CONFERENCE:
   1. A pre-roofing conference is required before any roofing materials are installed. This conference shall be conducted by a representative of the Architect and attended by representatives of the Owner, General Contractor, Roofing Contractor, Sheet Metal Contractor, Roof Deck Manufacturer (if applicable) and the Roofing Materials Manufacturer (if warranty is required of this manufacturer). If equipment of substantial size is to be placed on the roof, the Mechanical Contractor must also attend this meeting.
   2. The pre-roofing conference is intended to clarify demolition (for renovation or re-roofing projects) and application requirements for work to be completed before roofing operations can begin. This would include a detailed review of the specifications, roof plans, roof deck information, flashing details and approved shop drawings, submittal data, and samples. If conflict exists between the specifications and the Manufacturer's requirements, this shall be resolved. If this pre-roofing conference cannot be satisfactorily concluded without further inspection and investigation by any of the parties present, it shall be reconvened at the earliest possible time to avoid delay of the work. In no case should the work proceed without inspection of all roof deck areas and substantial agreement on all points.
   3. The following are to be accomplished during the conference:
      a. Review all Factory Mutual and Underwriters Laboratories requirements listed in the specifications and resolve any questions or conflicts that may arise.
      b. Establish trade-related job schedules, including the installation of roof-mounted mechanical equipment.
      c. Establish roofing schedule and work methods that will prevent roof damage.
      d. Require that all roof penetrations and walls be in place prior to installing the roof.
      e. Establish those areas on the job site that will be designated as work and storage areas for roofing operations.
      f. Establish weather and working temperature conditions to which all parties must agree.
      g. Establish acceptable methods of protecting the finished roof if any trades must travel across or work on or above any areas of the finished roof.
   4. The Architect shall prepare a written report indicating actions taken and decisions made at this pre-roofing conference. This report shall be made a part of the project record and copies furnished the General Contractor, and the Owner.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's unopened, labeled bundles, rolls or containers.

B. Store materials to avoid water damage, and store rolled goods on end. Comply with manufacturer's recommendations for job-site storage and protection.

1.07 FIELD CONDITIONS

A. The Roofing Contractor shall accept the substrate prior to installation of roofing system.

B. Do not install shingles, eave protection membrane or underlayment when surface, ambient air, or wind chill temperatures are below 45 degrees F (7 degrees C).

C. Proceed with Shingle work only when weather conditions are in compliance with manufacturer's current written instructions and recommendation and when substrate is completely dry.

1.08 WARRANTIES AND GUARANTEES

A. Roofing and Wind Warranty: Provide shingle manufacturer's warranty on installed work, agreeing to pay for repair or replacement of defective shingles and as necessary to eliminate leaks. Period of warranty is forty (40) years from date of substantial completion.
   1. Asphalt shingles shall resist blow-off or damage caused by wind speeds up to and including 120 mph, or that shown on structural drawings.

B. Special Project Guarantee: Provide 3 fully executed copies of "Roofing Guarantee" on the form included in the "General CONDITIONS" Section of the Project Manual, covering the work of this Section, including in part, roofing, concealed and exposed flashings, roof decking and/or

sheathing, insulation, gravel stops, roof expansion joints, and other accessories, etc., signed by the General Contractor.

C. Provide all necessary roof, and related, components to achieve specified warranty.

D. Repairs that become necessary, such as for leaks, wind damage or temperature stress while roofing is under warranty and/or guarantee, shall be performed by the installer within 7-days of notification. Should for any reason, the installer not be able to perform the repairs, it shall be incumbent upon the manufacturer to do so. If repairs are not begun on time, Owner shall have work done by others and costs will be charged to the Contractor, with no detrimental effect on the remaining warranty and no termination of warranty.

E. The above warranty and guarantee shall be in addition to, shall be in effect simultaneously with, and shall not alter or limit other project or product warranties or guarantees, nor shall they serve as limitations to other remedies available to the Owner.

F. Standard manufacturer's roofing warranties and guarantees which contain language regarding the governing of the warranties and guarantees by any state other than the State of Alabama, must be amended to exclude such language, and substituting the requirement that the Laws of the State of Alabama shall govern all such warranties and guarantees.
   1. Unless manufacturer's warranty agrees to arbitration through the American Arbitration Association or directly references State of Alabama for enforcement, manufacturer shall provide warranty rider stating that manufacturer's warranty is governed by and shall be enforced in accordance with laws of Alabama, and that in the event of a conflict between the provisions of the Warranty and the provisions of the rider, the provisions of the rider shall control.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers/Products: Subject to compliance with requirements, provide one (1) of the following, or preapproved equivalent submitted at least 10 days prior to original Bid date and subsequently approved:
   1. Certainteed: www.certainteed.com.
   2. GAF Materials Corporation; Product "Timberline HDZ" [Basis of Design] or "Stormguard": www.gaf.com.
   3. Owens Corning Corp: www.owenscorning.com.

2.02 WIND UPLIFT RESISTANCE

A. Roof System shall comply with FM 1-90 requirements for wind uplift resistance.

2.03 SHEET MATERIALS

A. Roofing Underlayment: Grace Ice and Water Shield self-adhered roofing membrane, or approved equivalent.

2.04 ACCESSORIES

A. Nails: Standard round wire shingle type, of hot-dipped zinc coated steel, 12 gage, 0.105 inch (2.67 mm), to 10 gage, 0.134 inch, shank diameter, 3/8 inch (9.5 mm) head diameter, of sufficient length to penetrate 3/4 inch (19 mm) into roof sheathing or decking, or as recommended by roof shingle manufacturer. Nail shall be continuous ring shank, and shall be provided by American nail supplier.
   1. The use of square-head nails, staples, and pneumatic or electric nail guns is strictly prohibited.

B. Roofing Nails: Standard round wire shingle type, galvanized steel, stainless steel, aluminum roofing nails, or copper roofing nails, minimum 3/8-inch (9.5 mm) head diameter, 12-gauge, 0.109-inch (2.77 mm) nail shank diameter, 1-1/2 inches (38 mm) long and complying with ASTM F1667/F1667M.

C. Asphalt Roof Cement: ASTM D4586/D4586M, asbestos-free.

D. Rigid Ridge Vent: Manufacturer's standard rigid section high-density polypropylene or other UV-stabilized plastic ridge vent with nonwoven geotextile filter strips and with external deflector baffles; for use under ridge shingles.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. GAF Materials Corporation; Cobra Rigid Vent III [Basis of Design], or comparable product by one of the following:
      b. Air Vent Inc., a CertainTeed Company; ShingleVent II.
      c. Owens Corning; VentSure Ridge Vent.
      d. Trimline Building Products; Trimline Ridge Vent.

E. Soffit Vent: Manufacturer's standard heat resistant polypropylene vent for use at eaves.
   1. Manufacturers: Subject ot compliance with requirements, provide products by one of the following:
      a. Cor-A-Vent; S-400 Strip Vent; [Basis of Design]: www.cor-a-vent.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

F. Use fasteners that comply with manufacturer's recommendations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to starting this work.

B. Verify roof deck is of sufficient thickness to accept fasteners.

C. Verify roof penetrations and plumbing stacks are in place and flashed to deck surface.

D. Verify roof openings are correctly framed.

E. Verify deck surfaces are dry, free of ridges, warps, or voids.

F. Verify that self-adhered membrane flashing used as underlayment (specified in Section 07 6200) has been installed over all substrates scheduled to receive it.

3.02 PREPARATION

A. Seal roof deck joints wider than 1/16 inch (1.5 mm) as recommended by shingle manufacturer.

B. At areas where eave protection membrane is to be adhered to substrate, fill knot holes and surface cracks with latex filler.

C. Broom clean deck surfaces before installing underlayment or eave protection.

D. Install eave edge flashings tight with fascia boards. Weather lap joints 2 inches (50 mm) and seal with plastic cement. Secure flange with nails spaced in accordance with NRCA standards.

3.03 INSTALLATION

3.04 INSTALLATION - FELT UNDERLAYMENT

A. Coordinate the installation of the following with the requirements of Sheetmetal Flashing and Trim Section, including in part, self-adhered membrane flashing (below felts), continuous metal drip edge, and other materials indicated or otherwise required by project conditions.
   1. Apply one layer felt horizontally over entire surface, lapping succeeding courses 4-inches minimum and fastening with sufficient nails to hold in place until shingle application. Overlap 4-inches minimum at all valleys and ridges.

B. Weather lap and seal watertight with plastic cement any items projecting through or mounted on roof.

3.05 INSTALLATION - ACCESSORIES

A. Install accessories in accordance with manufacturer's recommendations and NRCA requirements.

B. Items Projecting Through or Mounted on Roofing: Flash and seal weather tight with plastic cement.

3.06 FIELD QUALITY CONTROL

A. See Section 01 400 - Quality Requirements, for general requirements for field quality control and inspection.

B. Require site attendance of roofing and insulation material manufacturers daily during installation of the Work, and at completion of the Work.
   1. Roofing manufacture shall be on site when the roofing installation starts to observe the installation of the underlayment, flashing, and installation of shingles. Manufacture shall generate an observation report for this day and send out no later than 72 hours of observation.
   2. Roofing manufacture shall make a site visit in the middle of the roofing installation and once at completion. Report shall include list of corrections to be made. Distribution of all reports shall include contractor and architect and sent out no later than 72 hours of observation.

C. Materials representative shall provide a final inspection report to Contractor and Architect at completion of project.

3.07 CLEANING

A. Remove all trash, scraps, debris, etc., from roof and site, which results from work under this Section, and legally dispose of off-site.

3.08 PROTECTION

A. Do not permit traffic over finished roof surface; protect roofing until completion of project.

END OF SECTION

SECTION 07 4646
FIBER CEMENT PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wood-fiber cement board.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 04 2000 - Unit Masonry: Soffit substrate.

C. Section 05 4500 - Light Gauge Steel Trusses.

D. Section 061000 - Rough Carpentry: Soffit substrate.

1.03 REFERENCE STANDARDS

A. ASTM C1186 - Standard Specification for Flat Fiber Cement Sheets; 2008.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Manufacturer's requirements for related materials to be installed by others.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods, including nail patterns.

C. Test Report: Applicable model code authority evaluation report (e.g. ICC-ES).

D. Maintenance Instructions: Periodic inspection recommendations and maintenance procedures.

E. Warranty: Submit copy of manufacturer’s warranty, made out in Owner’s name, showing that it has been registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum 3 years of experience.

B. Mock-Up:
   1. Construct a representative wall sample, 6 feet wide by 10 feet high, which includes face brick, mortar and accessories, architectural masonry veneer, cast stone, metal-framed storefronts, with masonry back-up and metal stud and sheathing backup where applicable; with accompanying flashing, sealants, and waterproofing (air barrier). Also, eave condition, including soffit and gutter is included. This panel will be for the purpose of approving the wall system and its components.
   2. Locate where directed, or indicated.
   3. Coordinate with work of other Sections.
   4. Approved mock-up will become standard for appearance and workmanship.
   5. Mock-up may not remain as part of the completed work.
   6. Remove mock-up not incorporated into the work and dispose of debris.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products under waterproof cover and elevated above grade, on a flat surface.

PART 2 - PRODUCTS

2.01 FIBER CEMENT PANEL

A. Soffit, Facia, and Trim Panels: Panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186 Type A Grade II; with machined edges, for nail attachment.

1. Texture: Smooth.
2. Length: 96 inches (2400 mm), nominal.
3. Width: 48 inches (1220 mm).
4. Thickness: 1/4 inch (__ mm), nominal, for soffit panels; thickness as indicated on drawings for facia and trim.
5. Finish: Field Paint, color selected by Architect.
6. Manufacturers:
   a. CertainTeed Corporation : www.certainteed.com.
   b. James Hardie Building Products, Inc; [Basis of Design]: www.jameshardie.com.
   c. Nichiha USA, Inc : www.nichiha.com.
   d. Substitutions: See Section 01600 - Product Requirements.

2.02 ACCESSORIES

A. Trim: Same material and texture as siding.

B. Fasteners: Galvanized or corrosion resistant; length as required to penetrate minimum 1-1/4 inch (32 mm).

C. Joint Sealer: As specified in Section 079005.

D. Insect Screen.

E. Construction Adhesive.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine substrate and clean and repair as required to eliminate conditions that would be detrimental to proper installation.

B. Do not begin until unacceptable conditions have been corrected.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and recommendations.
   1. Read warranty and comply with all terms necessary to maintain warranty coverage.
   2. Install in accordance with conditions stated in model code evaluation report applicable to location of project.
   3. Use trim details indicated on drawings.
   4. Touch up all field cut edges before installing.
   5. Pre-drill nail holes if necessary to prevent breakage.
   6. Install insect screen over vents, using construction adhesive.

B. Over Steel Studs: Use hot-dipped galvanized self-tapping screws, with the points of at least 3 screws penetrating each stud the panel crosses and at panel ends.

C. Do not install siding less than 6 inches (150 mm) from surface of ground nor closer than 1 inch (25 mm) to roofs, patios, porches, and other surfaces where water may collect.

D. After installation, seal all joints except lap joints of lap siding. Seal around all penetrations. Paint all exposed cut edges.

E. Finish Painting: Specified in Section 09 9000.

3.03 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings and counterflashings.

B. Sealants for joints within sheet metal fabrications.

C. Self-Adhered Membrane Flashing.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: General requirements for mock-ups.

B. Section 07 7123 - Manufactured Gutters and Downspouts.

C. Section 09 9100 - Painting: Field painting.

1.03 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

D. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products; 2025.

E. CDA A4050 - Copper in Architecture - Handbook; Current Edition.

F. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit two samples, 6 by 6 inches (___ by ___ mm) in size, illustrating metal finish color.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with three years of documented experience.

C. Mock-Up:

1. Construct a representative wall sample, 6 feet wide by 10 feet high, which includes face brick, mortar and accessories, architectural masonry veneer, cast stone, metal-framed storefronts, with masonry back-up and metal stud and sheathing backup where applicable; with accompanying flashing, sealants, and waterproofing (air barrier). Also, eave condition, including soffit and gutter is included. This panel will be for the purpose of approving the wall system and its components.
2. Locate where directed, or indicated.
3. Coordinate with work of other Sections.
4. Approved mock-up will become standard for appearance and workmanship.
5. Mock-up may not remain as part of the completed work.

6. Remove mock-up not incorporated into the work and dispose of debris.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch (0.61 mm) thick base metal.

B. Lead Sheet: ASTM B749, 0.047-inch (1.19 mm) minimum thickness; UNS Number L51121.

C. Self-Adhering Flashing - Around Windows, Doors, and Critical Wall Penetrations: Self-adhesive, rubberized asphalt bonded to polyethylene film, cold applied tape, with silicone-coated release sheet; 40 mil thickness; 12" wide roll, or as required. Provide primer when recommended by flashing manufacturer.
   1. Advanced Building Products Inc.; Peel-N-Seal, : www.advancedflashing.com.
   2. Carlisle Coatings & Waterproofing, Inc.; CCW-705-TWF, : www.carlisle-ccw.com.
   3. Grace, W. R. & Co.; Ice & Water Shield Strips: www.na.graceconstruction.com.
   4. Grace, W. R. & Co.; Perm-A-Barrier Wall Flashing: www.na.graceconstruction.com.

2.02 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18-inch (450 mm) long legs; seam for rigidity, seal with sealant.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

2.03 SELF-ADHERED MEMBRANE FLASHING

A. Self-Adhered Membrane Flashing: Used as underlayment under Shingle Roofs and Metal Siding (Occurring Over Solid Substrates): Self-Adhering, Rubberized Asphalt bonded to Polyethylene-Film, 40 mils (1.0 mm) thick minimum, consisting of slip-resisting polyethylene-film reinforcing and top surface laminated to SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer. Thermal stability: Unaffected at -20 deg. F.; ASTM D 1970.
   1. Carlisle Coatings & Waterproofing, Inc.; Dri-Start "A": www.carlisle-ccw.com.
   2. Grace, W. R. & Co.; Ice and Water Shield [Basis of Design]: www.na.graceconstruction.com.
   3. Johns Manville International, Inc.; Roof Defender: www.jm.com.
   4. Owens Corning; WeatherLock Flex: www.owenscorning.com.

B. Self-Adhered Membrane Flashing - High Temperature: Used as underlayment under Metal Roof or Horizontal Applications of Metal (Occuring Over Solid Substrates): 30 mils thick minimum, slip-resisting polyethylene-film-reinforced top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer. Thermal stability: Stable after testing at 240 deg. F., and unaffected at -20 deg. F.; ASTM D 1970.
   1. Carlisle Coatings & Waterproofing, Inc.; CCW WIP 300HT, : www.carlisle-ccw.com.
   2. CertainTeed Corporation; WinterGuard HT: www.certainteed.com.

3. Grace, W.R. & Co.; Ultra [Basis of Design]: www.na.graceconstruction.com.
4. Henry Company; Blue Skin PE-200HT: www.henry.com.

C. Install 1-layer over substrate surface at the following locations:
1. 36-inches wide in all valleys, over all hips and ridges (18-inches on each side of each valley, hip ridge, and top ridge), and at perimeter edges of shingle roof planes.
2. Below all metal roofing, and behind any metal wall panels and metal siding.
3. Where roofing planes intersect vertical walls and planes, turn edges up at least 8-inches.
4. Cover sheathing at corners.
5. Wrap head, jambs, and sill of all punched openings.

D. Coordinate with, and refer to Division 7 Roofing and Siding Sections for additional information and requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch (0.38 mm).

3.03 INSTALLATION

A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Seal metal joints watertight.

E. Install continuous through-wall flashing and sub-sill flashing with interior end dam prior to setting doors and windows. Typical at head and sill conditions. Jamb flashing to terminate in sub-sill flashing. Install metal head flashing at all window and door heads per manufacturer's standard detail.

F. Where sloping roof abutts a wall, integrate metal step flashing into the shingleroofing in accordance with best industry standards to provide weathertight joint.

G. Apply Self-Adhered Membrane Flashing used as underlayment in accordance with manufacturer's recommendations.
1. Lap in shingled manner.
2. Flash perimeter of wall openings.
3. Cover internal and external corners with additional layer of self-adhered membrane flashing.

H. Apply self-adhered flashing in accordance with manufacturer's recommendations.

END OF SECTION

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SECTION 07 7123
MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prefinished Aluminum-zinc alloy coated steel gutters and downspouts.

B. Splash guards.

1.02 RELATED REQUIREMENTS

A. Section 07 3113 - Asphalt Shingles: Sloped roofing system.

B. Section 07 6200 - Sheet Metal Flashing and Trim.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Comply with SMACNA (ASMM) for sizing components for rainfall intensity determined by a storm occurrence of 1 in 5 years.

B. Comply with applicable code for size and method of rain water discharge.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

1.06 QUALITY ASSURANCE

A. Mock-Up:
   1. Construct a representative wall sample, 6 feet wide by 10 feet high, which includes face brick, mortar and accessories, architectural masonry veneer, cast stone, metal-framed storefronts, with masonry back-up and metal stud and sheathing backup where applicable; with accompanying flashing, sealants, and waterproofing (air barrier). Also, eave condition, including soffit and gutter is included. This panel will be for the purpose of approving the wall system and its components.
   2. Locate where directed, or indicated.
   3. Coordinate with work of other Sections.
   4. Approved mock-up will become standard for appearance and workmanship.
   5. Mock-up may not remain as part of the completed work.
   6. Remove mock-up not incorporated into the work and dispose of debris.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Stack material to prevent twisting, bending, or abrasion and to provide ventilation. Slope to drain.

C. Prevent contact with materials that cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pre-finished Aluminum Sheet: ASTMB209, 0.040 inch thickness.
   1. Finish: Plain, shop pre-coated with PVDF (polyvinylidine fluoride) coating.
   2. Color: As indicated.

B. Primer: Zinc Molybdate Type.

C. Protective Backing Paint: Zinc Molybdate Alkyd.

2.02 GUTTERS AND DOWNSPOUTS

A. Gutters: Profile as indicated, or 6x6 inches, if not indicated.

B. Downspouts: Profile as indicated or 3.75 x 4.75 inches, if not indicated.

C. Anchors and Supports: Profiled to suit gutters and downspouts.
   1. Anchoring Devices: Type recommended by fabricator.
   2. Gutter Supports: Straps, unless indicated otherwise.
   3. Downspout Supports: Brackets, unless indicated otherwise.
      a. Provide minimum of 3 locations: top, middle and bottom, unless fabricator or SMACNA recommends more.
   4. Material: Same material as gutters and downspouts, unless fabricator recommends otherwise.

D. Fasteners: Same material and finish as gutters and downspouts, unless fabricator recommends otherwise.

E. Gutter dropouts at each downspout location. Filter screen shall be installed at each downspout location.

2.03 ACCESSORIES

A. Splash Pads: Precast concrete type, profile size(s) as indicated; minimum 3,000 psi (21 MPa) compressive strength at 28 days, with minimum 5 percent air entrainment.

2.04 ACCESSORIES

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify surfaces are acceptable for product installation in accordance with manufacturer's written instructions.

3.02 PREPARATION

A. Paint concealed sheet metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to minimum dry film thickness of 15 mils, 0.015 inch (0.381 mm).

3.03 INSTALLATION

A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.

B. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.

C. Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution, and rinse with water.

D. Set splash pans under downspouts.

END OF SECTION

SECTION 07 7230
EAVE VENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Eave vents.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to the work of this Section.

B. Section 06 1000 - Rough Carpentry.

C. Section 07 7100 - Roof Specialties.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 3000.

B. Product Data: Manufacturer's catalog data, standard details, and installation instructions.

C. Samples: 2 inch long samples of each profile required.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store products indoors and protect from construction traffic and damage.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Manufacturer: Provide vents fabricated by Cor-A-Vent, Inc.; P.O. Box 428; Mishawaka, IN 46546: www.cor-a-vent.com.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Eave Vents: Cor-A-Vent PS-400 Strip Vent [Basis of Design].
   1. Net free area: 10 sq in per lin ft.
   2. Dimensions: 1 inch wide by 48 inches long by 3/4 inch high.
   3. Color: As selected by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that framing is in place with proper clearance to receive vents.

3.02 INSTALLATION

A. Install eave vents in accordance with manufacturer's instructions.

3.03 EAVE VENTS

A. Install continuous vents full length of soffits, unless otherwise indicated.

B. Ensure that adequate blocking or barriers are installed to prevent insulation from impeding air flow.

3.04 ADJUST AND CLEAN

A. Remove any scrap from the site, and leave in a neat and clean condition.

END OF SECTION

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SECTION 07 8400
FIRESTOPPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Work described in this Section includes:
   1. Through penetration firestopping in fire rated construction.
   2. Construction-gap firestopping at connections of the same materials and different materials in fire rated construction.
   3. Construction-gap fire stopping occurring within fire rated wall, floor, floor-ceiling, and/or roof-ceiling assemblies.
   4. Construction-gap firestopping at the top of fire rated walls.
   5. Through-penetration smoke-stopping in smoke partitions.
   6. Construction-gap smoke-stopping in smoke partitions.

B. Related work Specified elsewhere includes:
   1. For structural, finish, and fire protection materials: Refer to the appropriate Specifications Sections.
   2. Fire dampers and manufactured devices: Refer to Divisions 21-23.
   3. Raceway seals and manufactured electrical devices: Refer to Division 26.

C. Unless specifically indicated otherwise, the party, trade, or subcontractor whose work penetrates fire-rated construction and/or fire-rated assemblies, shall be responsible for firestopping around their own penetrations.

D. In the event the General Contractor employs a Specialty Subcontractor for the required firestopping work, they shall notify all prospective Bidders, so as to avoid duplication in pricing.
   1. The Specialty Subcontractor shall provide coordination of requirements and the related work of other trades in advance of and as the Work progresses.

1.03 REFERENCED STANDARDS

A. Underwriters Laboratories - U.L. Fire Resistant Directory:
   1. Through-penetration fire stop devices (XHCR); Firestop Devices (XHJI).
   2. Fire resistant ratings (BXUV) (BXRH).
   3. Through-penetration firestop systems (XHEZ).
   4. Fill, void, or cavity material (XHHW).
   5. Joint Systems (XHBN) & Perimeter Fire Containment Systems (XHDG).

B. American Society for Testing and Materials Standards:
   1. ASTM E 814: Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
   2. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. ASTM E 1966: Standard Test Method for Fire Resistive Joints Systems.
   4. ASTM E 2307: (Perimeter).

C. Underwriters Laboratories, Inc.:
   1. UL 1479: Fire Tests of Through-Penetration Firestops.
   2. UL 2079: Tests for Fire Resistance of Building Joint Systems.
   3. UL 723: Surface Burning Characteristics of Building Materials.

D. NFPA 101 - Life Safety Code / NFPA 70 - National Electrical Code.

1.04 DEFINITIONS

A. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.

B. Barriers: Time rated fire walls, smoke barrier walls, time rated floor-ceiling and roof-ceiling assemblies, and structural floors and walls.

C. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gasses, and smoke.

D. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.

E. Construction Gaps: Gaps between adjacent sections of walls, exterior walls, at wall tops between top of wall and ceiling, and structural floors or roof decks; and gaps between adjacent sections of structural floors.

F. System: Specific products and applications, classified and numbered by Underwriters Laboratories, Inc., to close specific barrier penetrations.

G. Sleeve: Metal fabrication or metal pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

1.05 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Fire Rated Construction: Maintain barrier and structural floor fire ratings including resistance to cold smoke at all penetrations, connections with other surfaces and/or types of construction, at separations required to permit building movement and sound and/or vibration absorption, and at other construction gaps.
   2. Smoke Barrier Construction: Maintain barrier and structural floor resistance to cold smoke at all penetrations, connections with other surfaces and types of construction and at all separations required to permit building movement and sound and/or vibration absorption, and at other construction gaps.

1.06 SUBMITTALS

A. Submit in accordance with General Conditions, Division 1, and Section 01 0150 - “Special Conditions,” unless specifically indicated otherwise.

B. Product Data: Manufacturer’s written specifications and technical data including the following:
   1. Detailed specifications of construction and fabrication.
   2. Manufacturer’s current written installation instructions.
   3. Summary of test data for each product intended for use and limitations. Include name and address of the required independent testing laboratory and compliances obtained.

C. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.
   1. Details of each proposed assembly identifying intended products and applicable UL System number or UL Classified devices.
   2. Manufacturer or manufacturers representative shall provide qualified engineering judgments and drawings relating to non-standard applications as needed.

D. Quality Control Submittals: Statement of qualifications.

E. Applicators’ Qualifications Statement: List past projects indicating required experience.

1.07 QUALITY ASSURANCE

A. Specialty Contractor’s Qualifications: Firm experience in installation or application of systems similar in complexity to those required for this project, plus the following:
   1. Acceptable to or licensed by manufacturer, and to State, Local, and/or other authority having jurisdiction, where applicable.

2. At least 2-years experience with systems intended for use.
3. Successfully completed at least five projects of similar size, scope, and complexity using the systems intended for use.

B. Local and State Regulatory Requirements: Submit forms or acceptance for proposed assemblies not conforming to specific UL Firestop System Numbers or UL classified devices and/or systems. Engineering judgment documents must follow requirements set forth by the International Firestop Council.

C. Materials shall have been tested to provide fire rating at least equal to that of the construction.

1.08 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping:
1. Deliver products in original unopened packaging with legible manufacturer's identification.
2. Coordinate delivery with scheduled installation date, so as to allow minimum storage at site.

B. Storage and Protection: Store materials in a clean, dry, ventilated interior location. Store materials off of floor, and protect from soiling, abuse, moisture, and freezing. Follow manufacturer's written instructions when more stringent.

C. Remove damaged and/or contaminated materials immediately, legally dispose of off site, and Replace, at Contractor's expense.

1.09 PROJECT CONDITIONS

A. Existing Conditions:
1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding with work.
2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

B. Environmental Requirements:
1. Furnish adequate ventilation if using solvents.
2. Furnish forced air ventilation during installation if required by manufacturer and/or authorities having jurisdiction.
3. Keep Flammable materials away from sparks or flame.
4. Provide masking or drop cloths to prevent contamination of adjacent surfaces by firestopping materials.
5. Comply with manufacturer's written recommendations for temperature and humidity conditions before, during, and after installation of firestopping.

1.10 GUARANTEE

A. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, co-adhesion, abrasive resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, and/or general durability, and/or which appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality or characteristic of the material for the exposure indicated. The guarantee period shall be for 1-year from the date of "Substantial Completion."

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS AND PRODUCTS

A. Use only those listed in the UL Fire Resistance Directory for the UL System involved.

B. Products shall be as manufactured by one of the following , or pre-approved equivalent:
1. Dow Corning.
2. HILTI.
3. 3M Fire Protection Products.
4. Nelson Firestop Products.
5. Rector Seal Corp.; "Metacaulk" [Basis of Design]: www.rectorseal.com.

6. Specified Technologies, Inc.
7. Tremco, Div. of RPM Corporation.

C. All firestopping products must be from a single manufacturer.

D. All trades shall use products from the same manufacturer.

2.02 THROUGH-PENETRATION FIRESTOPPING OF FIRE-RATED CONSTRUCTION

A. Systems or devices listed in the UL Fire Resistance Directory under categories XHCR (XHJI) and XHEZ may be used, providing that they conform to the construction type, penetrant type, annular space requirements, and fire rating involved in each separate instance, and that the system be symmetrical for wall applications. Systems or devices must be asbestos-free.
   1. Additional requirements: Withstand the passage of cold smoke either as an inherent property of the system, or by the use of a separate product included as a part of the UL system or device, and designated to perform this function.

2.03 CONSTRUCTION-GAP FIRE STOPPING OF FIRE-RATED CONSTRUCTION

A. Firestopping at construction gaps between edges of floor slabs and exterior wall construction.

B. Firestopping at construction gaps between tops of partitions and under side of structural systems.

C. Firestopping at construction gaps between tops of partitions and underside of fire-rated ceiling or ceiling assembly.

D. Firestopping of control joints in fire rated masonry partitions.

E. Firestopping expansion joints.

F. Acceptable manufacturers and products: Use only those listed in the UL Fire Resistant Directory for the UL System involved.

2.04 SMOKE STOPPING AT SMOKE PARTITIONS

A. Through-penetration smoke-stopping: Any system complying with the requirements for through-penetration firestopping in fire-rated construction, as specified in the “Referenced Standards” is acceptable, provided that the system includes the specified smoke seal or will provide a smoke seal. The length of time of the fire resistance may be disregarded, as applicable.

B. Construction-gap smoke-stopping: Any system complying with the requirement for construction-gap firestopping in fire-rated construction, as specified in the “Referenced Standards” is acceptable, provided that the system includes the specified smoke seal or will provide the smoke seal. The length of time of the fire resistance may be disregarded, as applicable.

2.05 ACCESSORIES

A. Fill, void, and cavity materials: As classified under category XHHW in the UL Fire Resistance Directory.

B. Forming materials: As classified under category XHKU in the UL Fire Resistance Directory.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion. Notify the General Contractor of such conditions.
   1. Verify barrier penetrations are properly sized and in suitable conditions for application of materials.
   2. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 PREPARATION AND CLEANING

A. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose materials, rust or other substances, that may effect proper fitting, adhesion, or the required fire resistance.

3.03 INSTALLATION

A. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's written instructions and recommendations.

B. Seal holes or voids made by penetrations to ensure an effective smoke barrier.

C. Where floor openings without penetrating items are more than 4-inches in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as required for floor system.

D. Protect materials from damage on surfaces subject to traffic.

E. Place firestopping in annular space around fire dampers before installation of damper's anchoring flanges, which are to be installed in accordance with fire damper manufacturer's written recommendations, unless specifically indicated otherwise.

F. Where large openings are created in walls, or floors to permit installation of pipes, ducts, cable tray, bus duct, or other items, close unused portions of opening with firestopping material tested for the application.

G. Install smoke firestopping as specified for firestopping.

H. Where rated walls are constructed with horizontally continuous air space, double width masonry, or double stud frame construction, provide vertical, 12-inch wide fiber dams for full thickness and height of air cavity at maximum intervals of 15'-0" on center.

3.04 FIELD QUALITY CONTROL

A. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by the Architect, building inspector, fire inspector, and/or other authority having jurisdiction.

C. Perform under this Section patching and repairing of firestopping caused by cutting or penetration by other trades, and/or by any other cause.

3.05 ADJUSTING AND CLEANING

A. Immediately clean-up spills of liquid components.

B. Neatly cut and trim materials as required.

C. Remove equipment, materials and debris, leaving area in undamaged and clean condition.

D. Legally dispose of excess materials, trash, debris, etc., off of site.

END OF SECTION

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SECTION 07 9005
JOINT SEALERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 07 1400 - Fluid-Applied Air Barrier: Sealants required in conjunction with substrates for fluid-applied waterproofing.

C. Section 07 8400 - Firestopping: Firestopping sealants.

D. Section 08 8000 - Glazing: Glazing sealants and accessories.

1.03 REFERENCE STANDARDS

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with other sections referencing this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Samples: Submit two samples, 6 by 6 inch (____x____ mm) in size illustrating sealant colors for selection.

D. Submit results of field sealant adhesion testing to Architect prior to start of work.

E. Manufacturer's Installation Instructions: Indicate special procedures.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

C. Verify sealant system is compatible with substrate before installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 - PRODUCTS

2.01 MANUFACTURERS/PRODUCTS

A. Type 1 - Silicone Sealants:
   1. Pecora Corporation; 890NST Ultra Low Modulus Architectural Silicone Sealant - Class 100: www.pecora.com.
   2. Dow Corning; Product 790: www.dowcorning.com.
   3. Tremco Global Sealants; Product Spectrem 1: www.tremcosealants.com.

B. Type 2 - Silicone Sealants:
   1. Dow Corning; Product 795: www.dowcorning.com.
   2. Pecora Corporation; Product 895: www.pecora.com.

3. Tremco Global Sealants; Product Spectrem 2: www.tremcosealants.com.

C. Type 3 - Polyurethane Sealants:
1. Sika Corporation; Product Sika Flex 2C: usa.sika.com.
2. Tremco; Dymeric 240 FC: www:tremcosealants.com.

D. Acrylic Sealants (ASTM C920):
1. Tremco Global Sealants: www.tremcosealants.com.
2. Red Devil; Siliconized Acrylic Construction Grade (35 Year) Sealant: www.reddevil.com.
3. Sherwin-Williams Company; Shermax Urethanized Elastomeric Sealant: www.sherwin-williams.com.

E. Butyl Sealants:
1. Bostik Inc: www.bostik-us.com.
2. Pecora Corporation: www.pecora.com.
3. Tremco Global Sealants: www.tremcosealants.com.
4. Substitutions: See Section 01600 - Product Requirements.

2.02 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Backing For Exterior Silicone Sealants: Jacketed, bi-cellular polyolefin "soft-rod" backer rods, as manufactured by ITP, Nomaco, or approved equal.

2.03 MISCELLANEOUS MATERIALS

A. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated.

B. Cleaners for Nonporous Surfaces: Provide non-staining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials which are not harmful to substrates and adjacent nonporous materials.

C. Masking Tape: Provide non-staining, non-absorbent type compatible with joint sealants and to surface adjacent to joints.

D. Expansion Joint Filler: Multi-purpose, Expansion-Contraction Joint Filler for slab joints. Thickness: 1/2 inch, unless indicated otherwise. Equal to W.R.Meadows Fibre Expansion Joint.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 FIELD QUALITY CONTROL

A. Perform field sealant testing for all exterior sealants that affect watertightness.
1. Test each material scheduled as a substrate for silicone sealants to verify substrate priming and preparation requirements.
2. Field sealant adhesion testing shall be performed by authorized representative of selected sealant manufacturer.
3. Submit results of field sealant adhesion testing to Architect prior to start of work.
4. Coordinate results of testing so that substrate preparation and priming requirements are known at time when needed by sealant applicator before sealant installation.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect sealants until cured.

END OF SECTION

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SECTION 08 1113
STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 08 7100 - Door Hardware.

C. Section 09 9100 - Painting: Field painting.

1.02 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2025.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2025.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

I. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2026.

J. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

K. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.

L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

M. DHI A115 Series - Specifications for Steel Doors and Frame Preparation for Hardware; Door and Hardware Institute; 2000 (ANSI/DHI A115 Series).

N. ITS (DIR) - Directory of Listed Products; Current Edition.

O. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

P. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2024.

Q. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.

R. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

S. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

T. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

U. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.

V. UL (DIR) - Online Certifications Directory; Current Edition.

W. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Provide doors and frames complying with Steel Door Institute “Recommended Specifications: Standard Steel Doors and Frames” (SDI-100) and as herein specified.

C. Provide steel doors and frames from a single manufacturer.

D. Fire-Rated Door Assemblies:
   1. Where fire-rated door assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 “Standard for Fire Doors and Windows,” and have been tested, listed and labeled in accordance with ASTM E 152 “Standard Methods of Fire Tests of Door Assemblies” by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.
   2. Labels mounted on doors and door frames must indicate the time rating of the door/frame assembly.
   3. Provide units listed and labeled by UL.
   4. Attach fire rating label to each fire-rated unit.
   5. Fire rating label must be accessible, permanent (embossed on metal label), and be kept legible at all times.
   6. Labels on frames with transoms or sidelights must identify that the opening assembly includes same.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

C. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage.

D. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided finish items are equivalent in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

E. Store doors and frames at building site under cover. Place units on minimum 4-inch-high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4-inch spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Steel Doors and Frames, (General):
   1. Ceco Door: www.cecodoor.com.
   2. Curries, Mason City, Iowa: www.curries.com.
   3. Mesker Industries, Inc.
   4. Republic Builders Products Corp./Subs. Republic Steel.

B. Substitutions: Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.

3. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
4. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
5. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

B. Materials:
1. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.
2. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM SA 568.
3. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, with ASTM A 525, G60 zinc coating, mill phosphatized.
4. Supports and Anchors: Fabricate of galvanized sheet steel of gage not less than that of door frame.
5. Inserts, Bolts and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.

C. Fabrication:
1. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at project site.
2. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel (at fabricator's option).
3. Fabricate exterior doors, panels and frames from galvanized sheet steel. Close top and bottom edges of exterior doors as integral part of door construction or by addition of minimum 16-gauge inverted steel channels.
    a. Use galvanizing repair paint for surfaces damaged by fabrication or welding.
4. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws and bolts.
5. Finish Hardware Preparation:
    a. Prepare doors and frames to receive mortise and concealed finish hardware in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A 115 series specifications for door and frame preparation for hardware.
    b. Reinforce doors and frames to receive surface applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.
    c. Locate finish hardware as indicated on final shop drawings, or if not indicated, in accordance with “Recommended Locations for Builders' Hardware,” published by Door and Hardware Institute.
6. Shop Painting:
    a. Clean, treat and paint exposed surfaces of steel door and frame units, including galvanized surfaces.
    b. Clean steel surfaces of mill scale, rust, oil, grease, dirt and other foreign materials before application of paint.
    c. Use galvanizing repair paint for surfaces damaged by fabrication or welding, prior to prime coat.

d. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.
e. Do not paint fire labels on doors or frames.

D. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Provide metal doors of types and styles indicated on drawings or schedules, or seamless hollow steel construction. Form exterior doors of hot dip galvanized steel.

B. Exterior Doors, Non-Fire-Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 3 - Extra Heavy-duty.
b. Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 1 - Full Flush.
d. Door Face Metal Thickness: 20 gage, 0.032 inch (0.8 mm), minimum.
2. Core Material: Polystyrene, 1 lbs/cu ft minimum density.
3. Top Closures for Outswinging Doors: Flush with top of faces and edges.
4. Door Face Sheets: Flush.

C. Exterior Doors, Fire-Rated:
1. Grade: ANSI A250.8 - SDI-100; Level 3 - Extra Heavy-Duty, Physical Performance Level A, Model 1 - Full Flush.
2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").
a. Provide units listed and labeled by UL (Underwriters Laboratories) - UL (BMD).
b. Attach fire rating label to each fire rated unit.
3. Door Face Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
4. Core: Mineral board.
5. Thickness: 1-3/4 inch (44.5 mm).
6. Top Closures : Flush with top of faces and edges.
7. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
8. Texture: Smooth faces.

D. Interior Doors, Non-Fire Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 2 - Heavy-duty.
b. Physical Performance Level B 500 000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 1 - Full Flush.
d. Door Face Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

E. Fire-Rated Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 2 - Heavy-duty.
b. Physical Performance Level B 500 000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 1 - Full Flush.
d. Door Face Metal Thickness: 20 gage, 0.032 inch (0.8 mm), minimum.

2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
   a. Provide units listed and labeled by UL (DIR) or ITS (DIR).
   b. Attach fire rating label to each fire rated unit.
3. Core Material: Mineral board.
4. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. General:
   1. Comply with the requirements of grade specified for corresponding door.
      a. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricated frames of minimum 16-gauge cold-rolled furniture steel for interior door frames; 14-gauge cold-rolled furniture steel for exterior door frames.
         1) Frames for doors 7'-10" or more in height and/or over 3'-5" in width: 14 gauge cold-rolled furniture steel, and one additional hinge, whether or not indicated in hardware schedule.
   2. Frames shall be formed by press brake with corners sharp and true. Corners shall be mitered and accurately fitted, and shall be fully electrically welded and then ground smooth. Removable spreaders shall be welded to the bottom of the frame. Frames shall be accurately mortised for hardware.
   3. Contractor shall verify width of throat opening required, before fabrication.
   4. A minimum of three wall anchors shall be provided at each jamb, except four at doors 7'-10" high or more, and six at doors 10-foot high or more. Anchors shall be attached to door frames, adjustable, suitable for wall conditions and job requirements, and shall be 16 gauge minimum. Floor anchors shall be provided and welded to foot of each jamb with two 5/16" holes for securing to the floor.
   5. Reinforcements of adequate gauge shall be provided for strikes, closers and brackets and other surface applied hardware for field drilling and tapping.

C. Exterior Door Frames: Fully welded type.
   1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
   2. Weatherstripping: Separate, see Section 08 7100.

D. Interior Door Frames: Fully welded type.

E. Interior Door Frames, Fire-Rated: Fully welded type.
   1. Fire Rating: Same as door, labeled.

F. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

G. ////////Frames for Fiberglass Reinforced Polyester Doors (FRP). Fully welded type.
   1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.

H. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

I. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

J. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches (102 mm) high to fill opening without cutting masonry units.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

A. Glazing: As specified in Section 08 8000 - Glazing.

B. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches (102 mm) as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

C. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
   1. Provide additional door silencers at doors over 3'-0" wide or 7'-0" in height.
   2. Provide silencers equivalent to "GJ64" silencers as manufactured by Glenn-Johnson Corp., for metal frames, when not provided under the work of Section 08 7100 - "Finish Hardware."

D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

2.07 FINISHES

A. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating. This coating shall be factory installed on all interior of all hollow metal frames. Field application is not acceptable.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. General: Install standard steel doors, frames and accessories in accordance with final shop drawings and manufacturer's data, and as herein specified.

B. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

C. Install fire rated units in accordance with NFPA 80.

D. Coordinate frame anchor placement with wall construction.

E. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

F. Placing Frames:
   1. Comply with provisions of SDI-1-06 “Recommended Erection Instructions for Steel Frames,” unless otherwise indicated.
   2. Remove before installation all spreader bars and braces used for shipping.
   3. Except for frames located at in-place concrete or masonry, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces leaving surfaces smooth and undamaged.
   4. In masonry construction, locate a minimum of 3 wall anchors per jamb at hinge and strike levels. Add 1 wall anchor per jamb at hinge and strike levels for each whole 1'-10" height increment over 6'-0"; Similar at glazed and cased openings.

5. At in-place concrete or masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices.
6. In metal stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. Attach wall anchors to studs with tapping screws. Add additional anchors as indicated in paragraphs above.
7. Install fire-rated frames in accordance with NFPA Std. No. 80

G. Door Installation:
1. Fit hollow metal doors accurately in frames, within clearances specified in SDI-100.
2. Place fire-rated doors with clearances as specified in NFPA Std. No. 80.

H. Install silencers after all painting of doors and frames has been completed.

I. Install door hardware as specified in Section 08 7100.

J. Comply with glazing installation requirements of Section 08 8000.

K. Coordinate installation of electrical connections to electrical hardware items.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Prime Coat Touch-up:
1. Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.
2. Use galvanizing repair paint for galvanized surfaces, prior to prime coat.

C. Final Adjustments: Check and readjust operating finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

D. Repair all dents, bends, and prying prior to painting.

3.06 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

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SECTION 08 1416
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire-rated, non-rated, and acoustical.

1.02 RELATED REQUIREMENTS

A. Section 06 2000 - Finish Carpentry: Wood door frames.

B. Section 06 4000 - Architectural Woodwork: Millwork.

C. Section 08 1113 - Steel Doors and Frames.

D. Section 08 7100 - Door Hardware.

E. Section 08 8000 - Glazing .

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

C. ITS (DIR) - Directory of Listed Products; Current Edition.

D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025, with Amendment (2024).

E. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

F. UL (DIR) - Online Certifications Directory; Current Edition.

G. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, identify cutouts for glazing and louvers.

D. Samples: Submit two samples of stain colors, 6 x 6 inches minimum - on actual veneer chosen, for Architect to use to select stain color.

E. Verification Samples: Submit two samples of door veneer, minimum 24 x 24 inches in size illustrating wood grain, stain color, and sheen.

F. Manufacturer's Installation Instructions: Indicate special installation instructions.

G. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

B. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Haley Brothers: www.haleybros.com/#sle.
   2. Oshkosh Door Company: www.oshkoshdoor.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS

A. Doors: See drawings for locations and additional requirements.
   1. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with NFPA 252, UL 10B, or UBC Standard 7-2-94 ("neutral pressure"); UL or WH (ITS); Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
      a. Labeling of Fire Doors:
         1) Attach fire rating label to each fire rated unit.
         2) Fire rating label must be accessible, permanent (embossed on metal label), kept legible at all times, and shall contain the fire resistance rating in hours and/or minutes.
   3. Wood veneer facing with factory transparent finish.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

C. Sound-Rated Doors: Equivalent to type, with particleboard core (PC) construction as required to achieve STC rating specified; plies and faces as indicated above.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: White birch, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, center balance match of spliced veneer leaves assembled on door or panel face; unless otherwise indicated.
   1. Vertical Edges: Any option allowed by quality standard for grade.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

E. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

B. Factory finish doors in accordance with specified quality standard.
   1. Transparent Finish: Transparent catalyzed polyurethane, Premium quality, minimal sheen.
   2. Stain color shall match Architect's sample.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Coordinate installation of glazing.

3.03 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

END OF SECTION

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SECTION 08 3100
ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Access door and frame units, fire-rated and non-fire-rated, in wall and ceiling locations.

B. Attic Hatch.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 07 9005 - Joint Sealers.

C. Section 09 2116 - Gypsum Board Assemblies: Openings in gypsum ceilings or partitions.

D. Section 09 9100 - Painting: Field paint finish.

E. Divisions 22-26 Sections: Additional access doors provided and installed by Contractors for Plumbing, Mechanical, Electrical and related work.

1.03 SUMMARY

A. This Section includes access doors for installation in the following types of new construction:
   1. Gypsum drywall.
   2. Unit masonry.
   3. As otherwise indicated.

B. Provide fire-rated access doors where indicated or scheduled, and at access openings in all walls of stairs, elevator shafts and equipment rooms, other shafts and plumbing chase walls which are partially or fully open through floors, and at walls and ceilings indicated or required by Code to be fire-rated.

1.04 REFERENCE STANDARDS

A. UL (FRD) - Fire Resistance Directory; Current Edition.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
   1. Include complete schedule, including types, general locations, sizes, wall and ceiling construction details, finishes, latching or locking provisions, and other data pertinent to installation.

C. Shop Drawings: Indicate exact position of all access door units. Also indicate fabrication and installation of customized access doors and frames, including details of each frame type, elevations of door design types, anchorage and accessory items.

D. Manufacturer's Installation Instructions: Indicate installation requirements.

E. Project Record Documents: Record actual locations of each access unit.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire rated access doors.
   1. Provide access doors of fire rating equivalent to the fire rated assembly in which they are to be installed.
   2. Provide products listed and labeled by UL as suitable for the purpose specified and indicated.

B. Fire-Resistance Ratings: Wherever a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in Underwriters Laboratories, Inc.'s “Building Materials Directory” for rating shown.

1. Provide UL label on each fire-rated access door.
2. Fire rating label must be accessible, permanent (embossed on metal label), kept legible at all times, and shall contain the fire resistance rating in hours and/or minutes.

1.07 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain access doors for entire project from one source from a single manufacturer.

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard size units, which may vary slightly from sizes indicated.

C. Coordination: Furnish inserts and anchoring devices that must be built into other work for installation of access doors. Coordinate delivery with other work to avoid delay.

1.08 PROJECT CONDITIONS

A. Coordinate the work with other work requiring access doors.

B. Verification: Obtain specific locations and sizes for required access doors from trades requiring access to concealed equipment, and indicate on submittal schedule.

C. Special-Size Access Doors: Use where required or requested; indicate on schedule.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Wall and Ceiling Access Doors:
1. Acudor Products Inc: www.acudor.com.
2. Bar-Co., Inc.
3. Cesco Products
4. J.L. Industries [Basis of Design]: www.activarcpg.com/jl-industries/.
5. Karp Associates, Inc: www.karpinc.com.
6. Larsens Manufacturing Co.
7. Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.com.
8. Nystrom: www.nystrom.com.
9. The Williams Brothers Corp.
10. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ATTIC HATCH

A. Nystrom Building Products: www.nystrom.com. Product: NT, Steel Access Door, 36 inch by 36 inch, with 1 inch flange at perimeter, constructed of 14 gauge steel at door, 16 gauge at frame. 1 year warranty. Powder coat. For ceiling mount. Latch: As selected by Architect.
1. Substitutions: See Section 01 6000 - Product Requirements.

B. SP Partners, LLC.: www.rainbowatticstair.com. Product: F Series Steel Access Ladders. Must be able to hold a minimum live load of 500 pounds. Ladder to be 14
1. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESS DOORS AND PANELS

A. All Units: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.

B. Units in Fire Rated Assemblies: Fire rating equivalent to the fire rated assembly in which they are to be installed.

2.04 MATERIALS AND FABRICATION: ACCESS DOOR UNITS - WALLS AND CEILINGS

A. Door and Frame Units: Formed steel.
1. General: Furnish each access door assembly manufactured as an integral unit, complete with all parts, and ready for installation.
2. Steel Access Doors and Frames: Fabricate units of continuous welded steel construction, unless otherwise indicated. Grind welds smooth and flush with adjacent surfaces.

Furnish attachment devices and fasteners of type required to secure access panels to types of support shown.

3. Frames and flanges: 0.058 inch (1.5 mm) steel.
   a. Fabricate frame with exposed flange, nominal 1-inch wide around perimeter of frame for units installed in the following construction:
      1) Exposed masonry.
      2) Exposed concrete.
      3) Exposed siding.
   b. For gypsum drywall or gypsum veneer plaster, furnish perforated flange frames with drywall bead.
   c. For full-bed plaster and E.I.F.S. applications, furnish frames with galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.
4. Door panels: 0.070-inch single thickness steel sheet.
   a. Painted Flush Panel Doors (non-fire-rated and fire-rated): Fabricate from not less than 16-gage galvanized sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees. Finish with manufacturer's factory-applied prime paint.
      1) Restore any damage to galvanized finish with cold-process galvanizing repair paint, prior to applying factory prime coating, or other finishes.
   b. Stainless Steel Flush Panel Doors: Fabricate from not less than 18-gage stainless steel sheet, with concealed spring hinges or concealed piano hinge set to open 175 degrees. Buff exposed surfaces to #4 satin finish, except where other finishes are indicated.
5. Size: As indicated or as necessary to access and service equipment.
6. Hardware:
   a. Hardware for Fire-Rated Units: As required for listing.
   b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
   c. Hinge: 175 degree steel piano hinge with removable pin.
   d. Latch/Lock: Screw driver slot for quarter turn cam latch.
7. Galvanized, hot dipped finish, except where indicated otherwise.
8. Finish: No. 4 finish for stainless units.

B. Non-Fire Rated Door and Frame Units in Walls:
   1. Provide manufacturer's standard flush panel/door and frame.

C. Fire Rated Door and Frame Units in Walls:
   1. For fire rated units, provide manufacturer's standard insulated flush panel/doors, with continuous piano hinge and self-closing mechanism.

D. Locking Devices: Furnish flush, screwdriver-operated cam locks of number required to hold door in flush, smooth plane when closed.

E. Finishes:
   1. Attic hatch: Phosphate dipped with factory applied primer coat.
   2. Exterior: 3-coat 70% resin “Kynar 500” finish (i.e.: 7-mil prime coat, 9-mil color coat, and 9-mil clear top coat) with minimum 2.4 mil total dry film thickness, in color to match adjacent finish where occurs, unless otherwise selected by Architect from manufacturer's standard non-metallic colors - 15 colors minimum to select from, including white.
   3. Interior, Exposed to Normal View: To match finish on interior. Door "Finish Hardware" (refer to Section 08 7100), or if not indicated, to match existing hardware in room where occurs.
   4. Interior, in Service Areas, Above Ceilings, etc: Factory primed baked enamel.
   5. Toilet Rooms, Janitors Rooms, Kitchens, Kitchen Areas, Rooms Where Food is Stored, Prepared, Cooked and/or Served, and Break Rooms: Stainless steel, No. 4, satin finish.

2.05 FABRICATION

A. Weld, fill, and grind joints to ensure flush and square unit.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings in relation to adjacent finish surfaces. Secure rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

D. Coordinate installation with work of other trades.

E. Prepare perimeter of rough openings in concrete, CMU, and clay masonry with mortar/grout full-depth of wall and to size required; use pressure-treated wood as necessary for other concealed blocking, grounds, and supports at any stud wall construction.

3.03 ADJUST AND CLEAN

A. Adjust hardware and panels after installation for proper operation.

B. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Interior storefront.

C. Infill panels of metal and glass.

D. Aluminum doors and frames.

E. Weatherstripping.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: General requirements for mock-ups.

B. Section 05 5000 - Metal Fabrications: Steel attachment devices.

C. Section 08 1416 - Flush Wood Doors

D. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.

E. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2025.

B. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2024.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2026.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

E. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

F. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

G. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

H. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, and internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

D. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

E. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

F. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of professional structural engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with minimum 3 years of documented experience.

1.07 MOCK-UP

A. Construct a representative wall sample, 6 feet wide by 10 feet high, which includes face brick, mortar and accessories, architectural masonry veneer, cast stone, metal-framed storefronts, with masonry back-up and metal stud and sheathing backup where applicable; with accompanying flashing, sealants, and waterproofing (air barrier). Also, eave condition, including soffit and gutter is included. This panel will be for the purpose of approving the wall system and its components.

B. Locate where directed, or indicated.

C. Coordinate with work of other Sections.

D. Approved mock-up will become standard for appearance and workmanship.

E. Mock-up may not remain as part of the completed work.

F. Mock-up shall be used for testing of exterior storefront.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.09 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers:
   1. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Rabbet: For 1 inch (25 mm) insulating glazing for exterior applications. As indicated for interior applications.
   2. Glazing Position:
      a. Exterior: Outside glazed, front plane.
      b. Interior: Outside glazed, center plane, unless indicated otherwise.
   3. Water Leakage Test Pressure Differential: 12 lbf/sq ft (575 Pa).
   4. Air Infiltration Test Pressure Differential: 6.24 psf (300 Pa).
   5. Finish for exterior storefront: Class I color anodized.
   6. Finish for interior storefront: High performance organic coating.
   7. Finish Color: As selected by Architect from manufacturer's standard line.
   8. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   9. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   10. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   11. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   12. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
   13. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Performance Requirements
   1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
      a. Design Wind Loads: Comply with requirements of ASCE 7.
      b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
   2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf (390 Pa).
   3. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf (75 Pa) pressure difference.
   4. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.

5. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min/sq ft (0.3 L/s/sq m) of wall area, measured at specified differential pressure across assembly in accordance with ASTM E283.
6. Water Leakage: None, when measured in accordance with ASTM E331 at specified pressure differential.
7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

2.03 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
   1. Framing members for interior applications need not be thermally broken.
   2. Glazing Stops: Flush.
   3. Cross-Section: 2 x 4-1/2 inch nominal dimension, for interior and exterior applications.

B. Swing Doors: Glazed aluminum.
   1. Thickness: 1-3/4 inches (43 mm).
   2. Top Rail: 3-1/2 inches (____ mm) wide.
   3. Vertical Stiles: 3-1/2 inches (____ mm) wide.
   4. Bottom Rail: 10 inches (254 mm) wide.
   5. Glazing: Single glazed.
   6. Glazing Stops: Square.
   7. Finish: Same as storefront.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.

C. Glass: As specified in Section 08 8000.

D. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

E. Glazing Accessories: See Section 08 8000.

2.05 FINISHES

A. Superior Performing Organic Coatings: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride (PVDF) system.

B. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system.

C. Color: As selected by Architect from manufacturer's standard range.

2.06 HARDWARE

A. Door Hardware: Storefront manufacturer's standard type to suit application.
   1. Include for each door: continuous hinge and weatherstripping.

B. Other Door Hardware: See Section 08 7100.

2.07 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

E. Arrange fasteners and attachments to conceal from view.

F. Reinforce components internally for door hardware.

G. Increase gauge or reinforce framing members as required for imposed loads and span conditions.

H. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
   1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Install hardware using templates provided.

J. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 08 8000.

K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm per m) non-cumulative or 0.06 inch per 10 feet (1.5 mm per 3 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

B. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.
   1. Perform a minimum of two tests in each designated area as indicated on drawings.
   2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

C. Provide field testing of installed storefront system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.
   1. Perform a minimum of two tests in each designated area as indicated on drawings.
   2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
   3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf (200 Pa).
      a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce (14 gram) that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.

D. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 5413
FIBERGLASS CLAD WOOD WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fixed fiberglass clad wood windows.

B. Factory glazed.

C. Perimeter sealant.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 07 9005 - Joint Sealers: Perimeter sealant and back-up materials.

1.03 REFERENCE STANDARDS

A. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

B. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

C. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2000 (Reapproved 2008)

D. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact; 2007.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, anchorage and fasteners, glass, internal drainage details.

C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, installation requirements.

D. Samples: Submit two corner sash sections, 8x8 inch (____x____ mm) in size, illustrating window frame section.

E. Submit two samples of operating hardware.

F. Manufacturer's Certificate: Certify that products of this section meet or exceed specified requirements.

G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.

1.07 MOCK-UP

A. Include Fiberglass Windows in Mock-Up as described in Section 01 4000 - Quality Requirements, and on drawings.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.

B. Jig, brace, and box the window frame assemblies for transport to minimize flexing of members or joints.

1.09 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).

B. Maintain this minimum temperature during and after installation of sealants.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a ten year period after Date of Substantial Completion.

C. Provide twenty year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same.

D. Provide manufacturer's 10 year warranty for window assembly and components, including degradation of color finish.

E. Provide manufacturer's 20 year warranty against stress cracks in glass.

F. Provide manufacturer's 10 year warranty covering hardware and other non-glass components from manufacturing defects.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fiberglass-Clad Wood Windows:
   1. Marvin; ; [Basis of Design]: www.marvin.com.
   2. Substitutions: See Section 01600 - Product Requirements.

2.02 WINDOW UNITS

A. Fiberglass-Clad Wood Windows:
   1. Fiberglass: Pultruded, reinforced fiberglass.
   2. Wood veneer: Clear pine veneer. 0.020 inches thick nominal, with manufacturer's recommended backing. Water repellent preservative treated.
   3. Performance Requirements: ANSI/AAMA/101/I.S.2.
   4. Configuration: Direct set, unless indicated otherwise.

B. Performance Requirements:
   1. Forced Entry Resistance: Conform to ASTM F588 requirements for performance level 10 for window type A.
   2. System Design: Design and size components to withstand dead and live loads caused by pressure and suction of wind acting normal to plane of window.
      a. Calculate design pressures in accordance with applicable code
      b. Measure performance of units by testing in accordance with ASTM E330/E330M, using test pressure equal to 1.5 times the design wind pressure and 10 second duration of maximum load.
   3. Deflection: Limit member deflection to 1/200 of the longer dimension with full recovery of glazing materials.
   4. Assembly: To accommodate, without damage to components or deterioration of seals, movement between window and perimeter framing, deflection of lintel.
   5. Air Infiltration: Limit air infiltration through assembly to 0.3 cu ft/min/sq ft (____ L/s/sq m) or less, of frame single-hung, measured at a reference differential pressure across assembly of 1.57 psf (75 Pa) as measured in accordance with _____.
   6. Vapor Seal: No vapor seal failure at interior static pressure of 1 inch (25 mm), 72 degrees F (22 degrees C), and 40 percent relative humidity.

7. Water Leakage: None, when measured in accordance with ASTM E331 at 6.0 psf.
8. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.
9. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound. Position thermal insulation on exterior surface of air barrier and vapor retarder.
10. Thermal Movement: Design sections to permit movement caused by thermal expansion and contraction of fiberglass to suit glass, infill, and perimeter opening construction.

2.03 COMPONENTS

A. Frames: Pultruded reinforced fiberglass 0.070 (nominal) inch wall thickness.
   1. Type: Nailing flange (for new windows)
   2. Frame Corners: Joined per manufacturer's standard.
   3. Frame depth:
      a. Fiberglass-Clad Wood: 4-9/16".
   4. Jamb Depth: 2".

B. Sills: Pultruded fiberglass: 10-degree (nominal) sloped for positive wash.

C. Sash: Pultruded fiberglass, 15/16-inch thickness.
   1. Provide custodial locks (for use by authorized personnel) for operable windows.

D. Fasteners: Stainless steel.

2.04 GLASS AND GLAZING MATERIALS

A. Select quality complying with ASTM C 1036. Insulating glass SIGMA/IGCC when tested in accordance with ASTM E 2190. STC/OITC ratings are tested to the stated performance level in accordance with ASTM E 90-09.

B. Glass and Glazing Materials:
   1. Glass in Exterior Lights: High Performance LowE.
      a. Comply with Alabama Energy Code
   2. U-value = 0.65. SHGC = 0.25

2.05 SEALANT MATERIALS

A. Perimeter Sealant and Backing Materials: Type as specified in Section 07 9005.

B. Glazing Sealant: Silicone bedding at exterior.
   1. Interior with glazing boot.

C. Sealant Used Within System (Not Used for Glazing): Type recommended by manufacturer.

2.06 FABRICATION

A. Fabricate framing, mullions and sash members with fusion welded corners and joints, in a rigid jig. Supplement frame sections with internal reinforcement where required for structural rigidity.

B. Form sills in one piece. Slope sills for wash.

C. Form snap-in glass stops, closure molds, weather stops, and flashings for tight fit into window frame section.

D. Form weather stop flange to perimeter of unit.

E. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

F. Arrange fasteners to be concealed from view.

G. Permit internal drainage weep holes and channels to migrate moisture to exterior. Provide internal drainage of glazing spaces to exterior through weep holes.

H. Double weatherstrip operable units.

I. Factory glaze window units.

2.07 FINISHES

A. Factory baked-on acrylic organic coating system. Meet AAMA 624-10 requirements.

B. Color:
   1. Exterior: As selected by Architect from minimum of 6 of manufacturer's colors.
   2. Interior of Fiberglass Clad Wood Windows: Treated bare wood.
      a. Unfinished stain grade with no exposed fasteners, holes, or fingerjoints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.

3.02 INSTALLATION

A. Install window units in accordance with manufacturers instructions.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

D. Install sill.

E. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

F. Coordinate attachment and seal of perimeter air and vapor barrier materials.

G. Install perimeter sealant and backing materials in accordance with Section 07 9005.

3.03 TOLERANCES

A. Maximum Variation from Level or Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 0.5 inches per 100 ft (12 mm/30 m), whichever is less.

3.04 FIELD QUALITY CONTROL

A. Test installed windows by an approved testing agency approved and paid for by the Owner for compliance with specified performance requirements for water penetration, in accordance with AAMA 502-08 Field Testing using uniform pressure and same pressure difference as specified for laboratory tests.
   1. [VERIFY MFRS AIR & WATER PERFORMANCE FOR APPROPRIATE WINDOW TYPE.]
   2. Architect and Owner shall select three (3) windows of the first 25 installed windows for Field verification of performance.
   3. If any window fails, test two (2) additional windows of Architect's choosing at Contractor's expense.

B. Repair or replace windows that have failed field testing and retest until performance is satisfactory. Any repairs made to installed windows to demonstrate compliance with performance shall also be made to all other windows.

3.05 ADJUSTING

A. Adjust hardware for smooth operation and secure weathertight closure.

3.06 CLEANING

A. Remove protective material from pre-finished surfaces.

B. Wash surfaces by method recommended and acceptable to sealant and window manufacturer; rinse and wipe surfaces clean.

C. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

3.07 PROTECTION

A. Protect windows from damage until Substantial Completion.

B. Replace damaged windows that cannot be repaired to Architect's satisfaction.

3.08 CLOSE OUT DOCUMENTS

A. Provide manufacturer's maintenance manual as an electronic file.

B. Conduct scheduled walk-thru with Owner's representative to discuss routine service and maintenance.

END OF SECTION

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SECTION 08 8000
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glass.

C. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.

B. Section 08 4313 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.

C. Section 10 2800 - Toilet, Bath, and Laundry Accessories: Mirrors.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

D. ASTM C1036 - Standard Specification for Flat Glass; 2025.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.

F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2024, with Editorial Revision (2025).

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.

H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.

I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2024.

J. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.

K. GANA (GM) - GANA Glazing Manual; 2022.

L. GANA (SM) - GANA Sealant Manual; 2008.

M. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Provide compatibility testing of IGU edge seal with glazing compounds and setting blocks, and submit results of testing.

E. Samples: Submit two samples 12 by 12 inch (___ by ___ mm) in size of glass and plastic units, showing coloration and design.

F. Certificate: Certify that products of this section meet or exceed specified requirements.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Insulating Glass Units: One of each glass size and each glass type.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods.

B. Labeling: Furnish each pane of fire resistance-rated glazing and each pane of safety glazing with a permanent identification which meets the requirements of the latest approved edition of the International Building Code.

C. Glazing Standards: Comply with recommendations of Glass Association of North America (GANA) "Glazing Manual" and "Sealant Manual", and SIGMA TM-3000, "Vertical Glazing Guidelines", except where more stringent requirements are indicated. Refer to those publications for definitions of glass and glazing terms not otherwise defined in this section or other referenced standards.

D. Safety Glazing Standard: Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category II materials.

E. Fire Resistance Rated Glass: Provide glass products that meet CPSC 16 CFR 1201, Category II requirements for fire-rated glass and are labeled and listed by UL or other testing and inspecting agency acceptable to authorities having jurisdiction.

F. Insulating Glass Certification Program: Provide insulating glass units permanently marked either on spacers or at least one component pane of units with appropriate certification label of the inspecting and testing organization indicated below.
   1. Insulating Glass Certification Council (IGCC).
      a. ASTM E 2190.

G. Installer Qualifications: Company specializing in performing work of type specified, with minimum 3 years of documented experience.

1.07 MOCK-UPS

A. Include Glazing in Mock-Up as described in Section 01 4000 - Quality Requirements.

1.08 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Sealed Insulating Glass Units: Provide a ten (10) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

C. Replacements Under Warranties: Provide same warranty as original glass and glazing, beginning from date of replacement completion for glass units replaced under Warranty provisions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:
   1. Guardian Glass, LLC: www.guardianglass.com/#sle.

2. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.

2.02 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
   2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
   3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
   4. Tinted Type: ASTM C1036, Class 2 - Tinted, with color and performance characteristics as indicated.
   5. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

B. Fire-Protection-Rated Glazing: Type, thickness, and configuration as required to achieve indicated ratings.
   1. IBC Fire Protection Rating: As indicated on drawings.
   2. Provide products listed by Underwriters Laboratories or Intertek Warnock Hersey.
   3. Labeling: Provide permanent label on each piece giving the IBC rating and other information required by the applicable code.

C. Fire-Protection-Rated Glazing:
   1. IBC Fire Protection Rating: D-H-T-90 or W-90, minimum.

D. High Impact-Resistant Tempered Safety Glazing: Complying with 16 CFR 1201 test requirements for Category II.

E. Glass-Ceramic Safety Glazing: UL- or WH-listed as fire-protection-rated glazing and complying with 16 CFR 1201 test requirements for Category II without the use of a surface-applied film.

F. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3, and complying with other requirements specified.

G. Mirror Glass : ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality Q1 (mirror select); silvering, protective coating and physical characteristics complying with ASTM C1503; 6 mm minimum thick.
   1. Sizes noted on Drawings.

H. One-Way Mirror Glass: Mirror quality float glass (Q2) with factory coating. Tempered where indicated, or required.

2.03 INSULATING GLASS UNITS

A. Manufacturers:
   1. Glass: Any of the manufacturers specified for float glass.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Metal-Edge Spacers: Aluminum, bent and soldered corners.
   3. Spacer Color: As selected by Architect.
   4. Edge Seal: Primary seal - Polyisobutylene. Secondary seal - Silicone.
   5. Purge interpane space with dry air, hermetically sealed.

C. Type IG-1 - Sealed Insulating Glass Units: Vision glass, low-E.
   1. Applications: Exterior glazing unless otherwise indicated.
   2. Space between lites filled with air.
   3. Outboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick, minimum.
      a. Tint: As Selected.
      b. Coating: Low-E (passive type), on #2 surface.
   4. Inboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick, minimum.
      a. Tint: Clear.
   5. Edge Spacer: See "Sealed Insulating Glass Units" Article below.

6. Edge Spacer Color: See "Sealed Insulating Glass Units" Article below.
7. Total Thickness: 1 inch (25.4 mm).
8. Glazing Method: Gasket Glazing.

D. Type IG-2 - Sealed Insulating Glass Units: Spandrel glazing.
1. Applications: Exterior spandrel glazing unless otherwise indicated.
2. Outboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick, minimum.
   a. Tint: Clear.
   b. Coating: Same as on vision units, on #2 surface.
3. Inboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick.
   a. Tint: Clear.
   b. Opacifier: Ceramic frit, on #4 surface.
   c. Opacifier Color: As selected by Architect.
4. Total Thickness: 1 inch (25.4 mm).
5. Glazing Method: Gasket glazing.

E. Type IG-3 - Insulating Glass Units: Safety glazing.
1. Applications:
   a. Glazed sidelights and panels next to doors.
   b. Other locations required by applicable federal, state, and local codes and regulations.
   c. Other locations indicated on drawings.
2. Type: Same as other vision glazing except use fully tempered float glass for both outboard and inboard lites.
3. Edge Spacer: See "Sealed Insulating Glass Units" Article below.
4. Edge Spacer Color: See "Sealed Insulating Glass Units" Article below.

F. Type IG-4 - Sealed Insulating Glass Units: Spandrel Safety glazing:
1. Applications: Provide this type of glazing in the following locations, if spandrel glazing is indicated for these locations:
   a. Glazed lites in exterior doors.
   b. Glazed sidelights and panels next to doors.
   c. Other locations required by applicable federal, state, and local codes and regulations.
   d. Other locations indicated on the drawings.
2. Type: Same as other spandrel glazing except use fully tempered float glass for both outboard and inboard lites.
3. Tint and opacifier: As scheduled for other spandrel glazing.

G. Type E-1 - Single Exterior Vision Glazing:
1. Application: Exterior glazing not indicated to be Insulating Glass Units.
2. Type: Annealed float glass.
3. Tint: Tinted to match other exterior vision glazing.
4. Thickness: 1/4 inch (6 mm).
5. Glazing Method: Gasket glazing.

H. Type E-2 - Single Exterior Vision Glazing: Safety glazing.
1. Applications: Exterior glazing not indicated to be Insulating Glass Units, but required to be safety glazed.
   a. Glazed lites in exterior doors.
   b. Other locations required by applicable federal, state, and local codes and regulations.
2. Type: Fully tempered float glass.
3. Tint: Tinted to match other exterior vision glazing.
4. Thickness: 1/4 inch (6 mm).
5. Glazing Method: Gasket glazing.

I. Type S-1 - Single Vision Glazing:
1. Application: All interior glazing unless otherwise indicated.
2. Type: Annealed float glass.

3. Tint: Clear.
4. Thickness: 1/4 inch (6 mm).
5. Glazing Method: Gasket glazing.

J. Type S-2 - Fire-Protection-Rated Glazing:
1. IBC Fire Protection Rating: D-H-T-90, minimum.
2. Safety Certification: 16 CFR 1201 Category II.
3. Application: Provide this type of glazing in the following locations:
a. Glazed lites in fire doors.
b. Fire windows.
c. Sidelights, borrow lites, and other glazed openings in partitions indicated as having an hourly fire rating.
d. Other locations indicated on the drawings.
4. Fire Rating: As indicated on the drawings.
5. Type: Glass-ceramic safety glazing.
6. Thickness: 1/4 inch (6 mm).
7. Glazing Method: As required for fire rating.

K. Type S-3 - Single Safety Glazing: Non-fire-rated.
1. Application: Provide this type of glazing in the following locations:
a. Glazed lites in doors, except fire doors.
b. Glazed sidelights to doors, except in fire-rated walls and partitions.
c. Other locations required by applicable federal, state, and local codes and regulations.
d. Other locations indicated on the drawings.
2. Type: Fully tempered float glass as specified.
3. Tint: Clear.
4. Thickness: 1/4 inch (6 mm).
5. Glazing Method: Gasket glazing.

L. Type S-4 - Single Laminated Glazing.
1. Application: Pass Thru Windows
2. Type: Laminated.
3. Tint: Clear.
4. Thickness: 1/2 inch (12 mm).

M. Mirror Glass: Where indicated.

N. One-Way Mirror: Where indicated.

2.04 GLAZING COMPOUNDS

A. Type GC-2 - Butyl Sealant: Single component; ASTM C920 Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

B. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; _____ color.

C. Manufacturers:
1. Bostik Inc: www.bostik-us.com/#sle.
2. Momentive Performance Materials, Inc: www.momentive.com/#sle.
3. Pecora Corporation: www.pecora.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

D. Glazing Putty: Polymer modified latex recommended by manufacturer for outdoor use, knife grade consistency; grey color.

E. Butyl Sealant: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

F. Acrylic Sealant: Single component, solvent curing, non-bleeding; ASTM C920, Type S, Grade NS, Class 12-1/2, Uses M and A; with cured Shore A hardness range of 15 to 25; color as selected.

G. Polysulfide Sealant: Two component; chemical curing, non-sagging type; ASTM C920, Type M, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

H. Polyurethane Sealant: Single component, chemical curing, non-staining, non-bleeding; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 20 to 35; color as selected.

I. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.05 ACCESSORIES

A. Setting Blocks: Neoprene, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch (75 mm) long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

D. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.

E. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option I; color as selected.

F. Glazing Clips: Manufacturer's standard type.

G. Speak Thru Intercom: Aluminum outside and inside face, 5-inch diameter, SST5 Brushed Stainless Steel finish.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.04 INSTALLATION - DRY GLAZING METHOD (TAPE AND GASKET SPLINE GLAZING)

A. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.

E. Carefully trim protruding tape with knife.

3.05 INSTALLATION - DRY GLAZING METHOD (TAPE AND TAPE)

A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

D. Place glazing tape on free perimeter of glazing in same manner described above.

E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

F. Carefully trim protruding tape with knife.

3.06 INSTALLATION - WET GLAZING METHOD (COMPOUND AND COMPOUND)

A. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch (610 mm) centers, kept 1/4 inch (6 mm) below sight line.

B. Locate and secure glazing pane using glazers' clips.

C. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.07 INSTALLATION - WET/DRY GLAZING METHOD (PREFORMED TAPE AND SEALANT)

A. Cut glazing tape to length and set against permanent stops, 3/16 inch (5 mm) below sight line. Seal corners by butting tape and dabbing with butyl sealant.

B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.

E. Install removable stops, with spacer strips inserted between glazing and applied stops 1/4 inch (6.4 mm) below sight lines.
   1. Place glazing tape on glazing pane of unit with tape flush with sight line.

F. Fill gap between glazing and stop with appropriate type sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch (9 mm) below sight line.

G. Apply cap bead of appropriate type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.08 INSTALLATION - WET/DRY GLAZING METHOD (TAPE AND SEALANT)

A. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.

D. Install removable stops, spacer shims inserted between glazing and applied stops at 24 inch (610 mm) intervals, 1/4 inch (6 mm) below sight line.

E. Fill gaps between pane and applied stop with appropriate type sealant to depth equal to bite on glazing, to uniform and level line.

F. Carefully trim protruding tape with knife.

3.09 INSTALLATION - BUTT JOINT GLAZING METHOD (SEALANT ONLY)

A. Temporarily brace glass in position for duration of glazing process; mask edges of glass at adjoining glass edges and between glass edges and framing members.

B. Temporarily secure a small diameter nonadhering foamed rod on back side of joint.

C. Apply sealant to open side of joint in continuous operation; thoroughly fill joint without displacing foam rod, and then tool sealant surface smooth to concave profile.

D. Permit sealant to cure then remove foam backer rod, and then apply sealant to opposite side, tool smooth to concave profile.

E. Remove masking tape.

3.10 INSTALLATION - MIRRORS

A. Install mirrors in accordance with GANA recommendations.

B. Install mirrors in correctly sized openings, using setting blocks (neoprene 80 to 90 Shore A durometer hardness), spacer shims, stainless steel clips, and adhesive compatible with mirror coating and wall substrate.

C. Set mirrors plumb and level, free of optical distortion.

D. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

3.11 FIELD QUALITY CONTROL

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.12 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

3.13 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

END OF SECTION

SECTION 08 9100
LOUVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvers, frames, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 6200 - Sheet Metal Flashing and Trim.

B. Section 07 9005 - Joint Sealers.

C. Division 23 - Mechanical Sections.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.

C. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2021, with Editorial Revision (2022).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.

D. Samples: Submit two samples 2 by 2 inches (50 by 50 mm) in size illustrating finish and color of exterior and interior surfaces.

E. Test Reports: Independent agency reports showing compliance with specified performance criteria.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.

1. Finish: Include twenty year coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.01 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.

1. Wind Load Resistance: Design to resist positive and negative wind load of 25 psf (of 1.2 kPa) without damage or permanent deformation.
2. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft (3.1 g/sq m) water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.

3. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
4. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.

B. Stationary Louvers: Horizontal blade, extruded aluminum construction, with concealed intermediate mullions.
1. Free Area: 57 percent, minimum.
2. Blades: Drainable.
3. Frame: Depth as indicated on drawings, channel profile; corner joints mitered and, with continuous recessed caulking channel each side and extended subsill.
4. Aluminum Thickness: Frame 12 gauge, 0.0808 inch (2.05 mm) minimum; blades 12 gauge, 0.0808 inch (2.05 mm) minimum.
5. Aluminum Finish: Class I natural anodized; finish welded units after fabrication.

2.02 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

2.03 FINISHES

A. Superior Performing Organic Coatings: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system.
1. Polyvinylidene fluoride (PVDF) multi-coat thermoplastic fluoropolymer coating system, including minimum 70 percent PVDF color topcoat and minimum total dry film thickness of 0.9 mil (0.023 mm); color and gloss as selected from manufacturer's full line, if not indicated on drawings.

B. Primer: Zinc chromate, alkyd type.

2.04 ACCESSORIES

A. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.

B. Bird Screen: Interwoven wire mesh of steel, 14 gauge, 0.0641 inch (1.63 mm) diameter wire, 1/2 inch (13 mm) open weave, diagonal design.

C. Insect Screen: 18 x 16 size aluminum mesh.

D. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.

E. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

F. Sealant: Type, as specified in Section 07 9005.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.

B. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

D. Secure louver frames in openings with concealed fasteners.

E. Install perimeter sealant and backing rod in accordance with Section 07 9005.

F. Coordinate with installation of mechanical ductwork.

3.03 CLEANING

A. Strip protective finish coverings.

B. Clean surfaces and components.

END OF SECTION

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SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud wall framing.
B. Metal channel ceiling framing.
C. Fire rated area separation walls.
D. Fiber reinforced backing board.
E. Gypsum wallboard.
F. Moisture-Resistant board.
G. Glass mat faced gypsum board sheathing.
H. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Structural steel stud framing.
B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
C. Section 07 1400 - Fluid-Applied Waterproofing: Water-resistive barrier and air barrier over sheathing. Sealant for sheathing on which fluid-applied waterproofing will be applied.
D. Section 07 2100 - Thermal Insulation: Acoustic insulation.
E. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.

1.03 REFERENCE STANDARDS

A. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data; 2017.
B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
C. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).
D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2025.
F. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).
G. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
H. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2026).
I. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
J. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2025.
K. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.
L. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.
M. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

N. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.

O. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2024.

P. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2025.

Q. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.

R. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

S. GA-600 - Fire Resistance and Sound Control Design Manual; 2024.

T. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data:

C. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

D. Test Reports: For stud framing products that do not comply with AISI S220 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.05 QUALITY ASSURANCE

A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.
   1. Maintain one copy of standards at project site.
   2. Where indicated, provide materials and construction which are identical with those of assemblies whose fire resistance rating has been determined per ASTM E 119 by a testing and inspecting organization acceptable to authorities having jurisdiction.

B. Single Source Responsibility: Comply with one of the following:
   1. Obtain all steel framing and all metal trim from a single manufacturer.
   2. Obtain each type of gypsum board and related joint treatment materials from a single manufacturer.
   3. Provide a confirmation letter from both the gypsum board manufacturer and the joint compound manufacturer that their products are compatible and warrantable if used together.

C. Construct a representative wall sample, 6 feet wide by 10 feet high, which includes face brick, mortar and accessories, architectural masonry veneer, cast stone, metal-framed storefronts, with masonry back-up and metal stud and sheathing backup where applicable; with accompanying flashing, sealants, and waterproofing (air barrier). Also, eave condition, including soffit and gutter is included. This panel will be for the purpose of approving the wall system and its components.

D. Pre-Construction Conference: Prior to beginning work associated with roof system, the Contractor and appropriate subcontractors shall meet to discuss coordination of the work of the trades associated with the installation of the roof system, suspended acoustical and gypsum board ceiling, suspended mechanical ductwork, suspended light fixtures, etc. This work shall be planned and coordinated to provide hanger attachments needed by the various trades in a manner that will minimize conflict with installation of the roof system.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire rated assemblies as indicated on drawings.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside, under cover, and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.

C. When materials are moved into the building, distribute pallets and loads evenly around work areas so as to avoid overloading structure, causing damage to any materials, interfering with work of other trades, etc.

D. Handle gypsum boards to prevent damage to edges, ends and surfaces. Do not bend or otherwise damage metal corner beads, trim, etc.

PART 2 PRODUCTS

2.01 METAL FRAMING MATERIALS

A. Material and Product Requirements: AISI S201 and AISI S220.

B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.

C. Manufacturers - Metal Framing, Connectors, and Accessories:
1. ClarkDietrich: www.clarkdietrich.com/#sle.
2. Dale/Incor: www.daleincor.com.
3. Falcon Metal and Supply Co.: www.falconms.com.
4. Marino: www.marinoware.com/#sle.
5. MBA Metal Framing: www.mbastuds.com.
6. United States Gypsum Company.

D. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (L/240 at 240 Pa). Install with flange edges bent back 90 deg. and doubled over to form 3/16-inch minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal and minimum depth as follows:
1. Metal studs at interior partitions shall be 3-5/8-inches x 20 gauge (362 S162-33), 6-inches x 20 gauge (600 S162-33), or 8-inches x 18 gauge (800 S162-43) at locations indicated on the Drawings, spaced at 16-inches o.c., unless otherwise indicated below or otherwise shown on drawings or required by project conditions. Stud width shall be 1-5/8-inches unless otherwise indicated.
2. Jamb studs shall be no less than 20 gauge.
   a. Studs shall be joined together at 4'-0" intervals.
3. Use double studs or 6-inch studs, as indicated or as otherwise required, for chase walls, piping, conduits, or etc.
4. Special stud tracks for curved walls shall be equivalent to "Flex-C Trac" galvanized flexible segmented track with slidable side straps, as manufactured by Flex-Ability Concepts, Inc.; Oklahoma City, OK.
5. Runners: U shaped, sized to match studs.
6. Ceiling Channels: C-shaped.
7. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
8. Resilient Furring Channels: 1/2 inch (12 mm) depth, for attachment to substrate through both legs; both legs expanded metal mesh.

E. Exterior Non-Loadbearing Studs and Furring for Application of Gypsum Board: As specified in Section 05 4000.

F. Loadbearing Studs for Application of Gypsum Board: As specified in Section 05 4000.
1. Studs: "C" shaped with flat or formed webs with knurled faces.
2. Any interior load-bearing studs shall be at least 6-inches depth x 18 gauge (600S162-43), or 8-inches x 18 gauge (800S162-43), unless otherwise indicated on Drawings –galvanized C-studs spaced at 16-inches o.c.

G. Shaft Wall Studs and Accessories: Galvanized sheet steel.

1. Metal studs at interior partitions shall be 3-5/8-inches x 20 gauge (362 S162-33), 6-inches x 20 gauge (600 S162-33), or 8-inches x 18 gauge (800 S162-43) at locations indicated on the Drawings, spaced at 16-inches o.c., unless otherwise indicated below or otherwise shown on drawings or required by project conditions. Stud width shall be 1-5/8-inches unless otherwise indicated.

H. Steel Framing Components for Suspended and Furred Ceilings:
   1. General: Provide components which comply with ASTM C 754 for materials and sizes, unless otherwise indicated.
   2. Wires for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
   3. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
   4. Steel Studs for Furring Channels: ASTM C 645, with flange edges bent back 90 deg. and doubled over to form 3/16-inch minimum lip (return), minimum thickness of base (uncoated) metal and minimum depth as follows:
      a. Thickness: 20 gauge, unless otherwise indicated.
      b. Depth: As indicated.
      c. Spacing: As indicated in referenced standard and on drawings, but no less than at all edges and 24-inches o.c.
   5. Steel Rigid Furring Channels: ASTM C645, hat-shaped, depth of 7/8-inch, and minimum thickness of base (uncoated) metal as follows:
      a. Thickness: 20 gauge at interior and 18 gauge at exterior, unless otherwise indicated.
      b. Spacing: As indicated in referenced standard and on drawings, but not less than at all edges and 16-inches o.c.
         1) At ceilings and soffits indicated to receive more than a single layer of gypsum board, spacing shall be not less than at all edges and 16-inches o.c.
   6. Grid Suspension System: ASTM C 645, manufacturer's standard grid suspension system composed of main beams and cross furring members which interlock to form a modular supporting network.
      a. Locations for Use: Provide grid type suspension systems for sloped and horizontal ceiling applications of interior gypsum board products which are not attached directly to primary framing system; Minimum 4-feet x 4-feet grid and cross tees at 2-feet o.c., with minimum installation requirements as required by manufacturer's current written instructions, referenced standards, and as indicated in this Section and Section 09511 - "Acoustical Panel Ceilings". Provide and comply with manufacturer's published requirements for accessories, trim and hanger wire, and as otherwise required to provide flat ceilings without deflection or sag.
      b. Product/Manufacturer: Provide suspended modular grid furring system equivalent to standard drywall suspension system for flat ceilings, with 1-1/2-inch grid faces, and as follows:
         1) Equivalent to "Drywall Suspension System", as manufactured by USG Interiors, or one of the other above named manufacturers.

I. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

J. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.
   1. Bottom Track: Unless otherwise indicated or required by project conditions, fire-ratings, etc., provide manufacturer's standard Deep Leg Tracks, unpunched unless otherwise indicated, of size, shape and gauge indicated, with 1-5/16-inch flange.
   2. Deflection Track: Typical at stud walls up to slab or similar fixed structure at top of walls: Provide for no less than 1" of vertical movement, equivalent to one of the following:
      a. Dietrich Double Track System
      b. Dietrich Track-Over-Track System
      c. Dietrich SLP-TRK slotted track system
      d. Dietrich TR-Series with Spazzer 9200 Bar (SPZD)

3. Special stud tracks for all curved walls shall be equivalent to "Flex-C Trac" galvanized flexible segmented track with slidable side straps, as manufactured by Flex-Ability Concepts, Inc.; Oklahoma City, OK.
4. Special stud tracks for all arched walls shall be equivalent to "Flex-C Arch" galvanized flexible segmented track with slidable straps, as manufactured by Flex-Ability Concepts, Inc.; Oklahoma City, OK.
5. Provide deflection track at exterior wall and floor-to-floor walls - typical.

K. Continuous Horizontal Bridging/bracing:
1. 1-1/2-inch cold-rolled channels (galvanized).
2. Spacing: 4'-0" or 4'-6" o.c. vertically, through pre-punched slots in studs.
3. Splice Plates: 16 gauge at all splices.
4. Anchors (bridging channels to studs): 1-1/2-inches x 2-inches x 16 gauge clip angle, 1/4-inch less than stud width, secured with four (4) 5/8-inch S-14 screws. (Anchors required at ends of runs, where snap-in fit to stud slots is not snug or allows stud to move/slide on channels, and at studs on each side of splices in bridging channels).

2.02 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
1. CertainTeed Corporation: www.certainteed.com/#sle.
2. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
3. National Gypsum Company: www.nationalgypsum.com/#sle.
4. USG Corporation: www.usg.com/#sle.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and horizontal surfaces, unless otherwise indicated.
2. Fire Resistant Type: Type X at all locations, unless other type is required by indicated tested assembly.
3. Thickness: 5/8 inch (16 mm).
4. Edges: Tapered.

C. Moisture and Mold-Resistant Paper-Faced Products:
1. Core Type: Type X.
2. Thickness: 5/8 inch (16 mm).
3. Edges: Tapered.
4. Application: At rooms with toilet fixtures and/or service sinks, entire wall behind sinks, and elsewhere as indicated or wherever water-resistant gypsum board is indicated.
5. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
6. Product:
   a. USG Sheetrock brand "Mold Tough" gypsum panels.
   b. Temple-Inland "ComfortGuard Mold Resistant Gypsum Board".
   c. Substitutions: See Section 01 6000 - Product Requirements.

D. Backing Board For Tile:
1. Fiber-Reinforced Gypsum Panels: As defined in ASTM C1278, mold-resistant, and with water-resistant core. No paper face.
2. Thickness: 5/8 inch.
3. Product:
   a. USG Fiberock brand "Aqua-Tough" Tile backerboard.
   b. Temple-Inland "GreenGlass Tile Backer".
   c. Substitutions: See Section 01 6000 - Product Requirements.
4. Application: Wall surfaces behind tile.

E. Gypsum Exterior Sheathing Board: Glass Mat gypsum sheathing board consisting of noncombustible gypsum core incorporating a water-resistant material, surfaced on face, back

and long edges with glass mats; complying with ASTM C 1177 and requirements indicated below:

1. Type: Type X at all locations. (Noncombustible.)
2. Edge and End Configuration: Square.
3. Thickness: 5/8-inch, unless indicated otherwise.
4. Size: 4'-0" x 8'-0" or 9'-0" as required for coordination with framing.
5. Products:
   a. Georgia Pacific "DensGlass Sheathing".
   b. CertainTeed Gypsum "GlasRoc Sheathing".
   c. Gold Bond "eXP Extended Exposure Sheathing".
   d. Lafarge North America "Weather Defense Platinum Type X".
   e. Temple-Inland "GreenGlass Exterior Sheathing".
   f. USG "Securock Exterior Sheathing".
6. Joints: Sealed and facing-taped joints. Polyurethane joint sealant reinforced with fiberglass mesh tape encapsulated in the sealant. Sheathing fastener heads shall be encapsulated with polyurethane sealant. Fiberglass reinforcement is not needed at sheathing fastener heads. NO acrylic latex sealant shall be used.
7. Extent: For Exterior sheathing, where plywood or other wood sheathing is not indicated.

2.03 GYPSUM BOARD ACCESSORIES

A. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

B. Finishing Accessories:
   1. Types: As detailed or required for finished appearance.
   2. Materials: 6063-T5 extruded aluminum alloy and G40 (Z120) galvanized steel sheet in accordance with ASTM A653/A653M.
   3. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

C. Extruded Moldings and Reveal Moldings: Provide manufacturer's standard alloy 6063-T5 extruded units with 70% resin 2-coat "Kynar 500" baked enamel finish, and as follows:
   1. Design: Provide shapes and configurations as indicated on the Drawings.
      a. Form reveal moldings to cover at least two sides and rear of reveal.
      b. At drywall (or plaster) edge, provide continuous expanded metal edge, designed for mudding-in.
      c. At ceiling grid edge, provide continuous edge designed for compatibility with lay-in ceiling grid.
   2. Color: To match ceiling grid in same room where occurs, unless indicated otherwise, and color as selected by Architect at any exterior locations.

D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners of glass-mat faced boards, and where recommended by manufacturer. Joint material shall be compatible with and approved by air barrier manufacturer, where applicable.
   2. Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners of paper faced boards, and where recommended by manufacturer.
   3. Ready-mixed vinyl-based joint compound.
   4. Chemical hardening type compound.

E. Vapor Barrier Joint Treatment: ASTM E2178 Vapor impermeable, self-adhered membrane.
   1. Semi-translucent air and vapor barrier, with acrylic pressure-sensitive adhesive
   2. Air Permeance: Less than 0.00005 cfm/sq ft at 75 Pa per ASTM E2178.
   3. Water Vapor Transmission: 0.26 US perm using Water Method per ASTM E96.
   4. For application in accordance with manufacturer's recommendations.
   5. Location: For Vapor Barrier at plenum ceiling, and where noted.

6. Manufacturer/Product:
   a. 3M Air and Vapor Barrier 3015: www.3M.com/industrial.
   b. Substitutions: See Section 01 6000 - Product Requirements.

F. Level 5 Surface System Options:
   1. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
   2. Factory-Applied Skim-Coated Drywall with matching Joint Compound: Rapid Deco Level 5 System by Lafarge.

G. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

H. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

I. Fasteners: Provide fasteners of type, material, size, corrosion resistance, holding power and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum drywall manufacturers for applications indicated.

J. Screws: ASTM C 1002; self-piercing tapping type; cadmium-plated for exterior locations.

K. Screws: ASTM C 954; steel drill screws for application of gypsum board to loadbearing steel studs.

L. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

M. Adhesive for Attachment to Wood, ASTM C557 and Metal:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.
   1. Environmental Requirements, General: Establish and maintain environmental conditions for application and finishing gypsum board to comply with ASTM C 840, with gypsum board manufacturer's recommendations, and with adhesive manufacturer's recommendations, for before, during, and after installation.
   2. Minimum Room Temperatures: For non-adhesive attachment of gypsum board to framing, maintain not less than 40º.
   3. Ventilate building spaces to remove water not required for drying joint treatment materials. Avoid drafts during dry, hot weather to prevent materials from drying too rapidly.

3.02 SEQUENCING AND SCHEDULING

A. Sequence installation of gypsum board and sheathing with installation of exterior cladding and roofing to comply with requirements indicated below:
   1. Do not leave gypsum sheathing board exposed to weather after its application for more than one month or, if protected as indicated below, for more than 6 months, unless otherwise warranted by manufacturer:
      a. Cover exterior surface of sheathing with a temporary air infiltration barrier equivalent to 6-mil polyethylene film. Apply covering immediately after sheathing is installed.
      b. Remove covering just prior to installation of asphalt felt, face brick, and similarly applied exterior materials.

3.03 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
   1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches (600 mm) on center.

2. Install studs at spacing required to meet performance requirements.

B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.
   1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
   2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.04 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Do not bridge building expansion and control joints with steel framing or furring members; independently frame both sides of joints with framing or furring members or as indicated.

C. Suspended Ceilings and Soffits: Space framing and furring members at 16 inches on center (at 400 mm on center).
   1. Level ceiling system to a tolerance of 1/1200.
   2. Laterally brace entire suspension system.
   3. Suspend ceiling hangers from building structural members and as follows:
      a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
      b. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapeze or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
      c. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
      d. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
      e. Secure hangers to structural support by connecting directly to structure where possible; otherwise, connect to anchorage devices or fasteners as indicated or required.
      f. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
      g. Do not attach hangers to steel deck tabs.
      h. Do not attach hangers to steel roof deck. Attach hangers to structural members.
      i. Do not connect or suspend steel framing from ducts, pipes or conduit.
      j. Keep hangers and braces 2-inches clear of ducts, pipes and conduits.
      k. Sway-brace suspended steel framing with hangers used for support.
      l. Install suspended steel framing components in sizes and at spacing indicated but not less than that required by referenced steel framing installation standard.
         1) Wire Hangers: 0.1620-inch diameter (8 gauge), 4-feet on center. Install supplementary hangers as necessary at ceiling fixtures to provide a hanger at each corner of each fixture, diffuser, grille, and other ceiling-mounted equipment.
      m. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross furring members to each other and butt-cut to fit into wall track.
   4. Install bracing as required at exterior locations to resist wind uplift.

D. Studs: Space studs at 16 inches on center (at 406 mm on center).
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Installation Tolerances: Install each steel framing and furring member so that fastening surface does not vary more than 1/8-inch from plane of faces of adjacent framing.
   3. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   4. Extend non-bearing wall partition framing to 6 inches above adjacent ceiling heights, except where partitions are indicated to terminate at suspended ceilings.
      a. Provide studs up to tie to structure at 4'-0" o.c. minimum, from partitions terminating below ceilings.
   5. Install steel studs and furring in sizes and at spacings, indicated but not less than that required by referenced steel framing installation standard.
   6. Install steel studs so that flanges point in the same direction and gypsum boards can be installed in the direction opposite to that of the flange.
   7. Install horizontal steel bridging/bracing in all walls, and the additional strap bracing at curved walls as steel framing progresses. Install in compliance with stud manufacturer's recommendations, at spacing indicated.
      a. Galvanized steel strap bracing shall be provided continuous at top and bottom runner tracks and at bridging locations at all curved stud walls.
   8. Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement, at locations indicated below to comply with details shown on Drawings:
      a. Where edges of suspended ceilings abut building structure horizontally at ceiling perimeters or penetration of structural elements.
      b. Where partition and wall framing abuts overhead structure:
         1) Unless framing is specifically indicated to terminate below ceilings, all framing and gypsum board shall extend up to bottom of structure above.
   9. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
   10. Install runners (tracks) at floors, ceilings and structural walls and columns, where gypsum drywall stud system abuts other construction.

E. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
   1. Frame door openings to comply with details indicated, with GA-219 and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
      a. Extend vertical jamb studs (double studs-typical) through suspended ceilings and attach to underside of floor or roof structure above, unless otherwise indicated.
   2. Frame openings other than door openings to comply with details indicated, or if none indicated, in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.
   3. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors and doors over 32-inches wide. Apply spot grout at each jamb anchor clip just before inserting board into frame.

F. Standard Wall Furring: Install at concrete and masonry walls scheduled to receive gypsum board, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.
   1. Orientation: Horizontal.
   2. Spacing: At 16 inches on center (At 400 mm on center).

G. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated and to GA-600 requirements.

H. Blocking: Install wood blocking for support of:
1. Framed openings.
2. Wall-mounted cabinets.
3. Plumbing fixtures.
4. Toilet partitions.
5. Toilet accessories.
6. Wall-mounted door hardware.
7. Heavy trim.
8. Shelving.
9. Furnishings.
10. Equipment services.

3.05 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Install "sound batts" and insulation as the work progresses. Refer to Section 07 2100 for additional information and requirements.

C. Acoustic Sealant: Install in accordance with manufacturer's instructions.
1. Place two beads continuously on substrate before installation of perimeter framing members.
2. Place continuous bead at perimeter of each layer of gypsum board.
3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.06 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. General application and finishing of gypsum Board:
1. Cut boards as recommended by manufacturer.
2. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 24-inches in alternate courses of board.
3. Install ceiling boards across framing in the manner which minimizes the number of end-butt joints, and which avoids end joints in the central area of each ceiling. Stagger end joints at least 24- inches.
4. Install wall/partitions boards in manner which minimizes the number of end-butt joints or avoids them entirely where possible. At high walls, install boards horizontally with end joints staggered over studs.
5. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16-inch open space between boards. Do not force into place.
6. Locate either edge or end joints over supports, except in horizontal applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
7. Attach gypsum board to steel studs so that leading edge or end of each board is attached to open (unsupported) edge of stud flange first.
8. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.
a. Cover both faces of steel stud partition framing with gypsum board in concealed spaces (above ceilings, etc.), except inside double or chase walls which are required to be braced internally.

1) Except where concealed application is required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. area, and may be limited to not less than 75% of full coverage.
2) Fit gypsum board around ducts, pipes, and conduits.
3) Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4-to-1/2-inch-wide joints to install sealant.

b. Fire-stop around penetrations as required by Codes and authorities having jurisdiction. Refer to Section 07840 for additional information and requirements.

9. Where interior partitions are indicated to extend to the structure above, the drywall shall also extend to the structure with the same number of layers as required below the ceiling.
10. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4-inch to 1/2-inch space and trim edge with "U" bead edge trim. Seal joints with acoustical sealant.
11. Gypsum panels applied to walls shall be applied with the bottom edge spaced a minimum of 1/4-inch above the floor.
12. At all interior walls, seal construction at perimeters of partition, partition intersections, control and expansion joints, openings and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of edge trim, and close off sound-flanking paths around or through construction, including sealing of partitions above acoustical ceilings.
    a. Offset boxes and similar openings minimum of one stud space, and insulate behind openings.
    b. Openings cut into wall for boxes shall leave maximum gap of 1/4" around box.
    c. Seal around box completely with acoustical sealant, or gasket recommended by manufacturer for acoustic isolation.
13. Space fasteners in gypsum boards in accordance with referenced gypsum board application and finishing standard and manufacturer's recommendations.

C. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
    1. Install gypsum wallboard as follows:
        a. On ceilings apply gypsum board prior to wall/partition board application to the greatest extent possible.
        b. On partitions/walls apply gypsum board vertically (parallel to framing), unless otherwise indicated or required for fire or smoke resistive rated assemblies. Provide maximum length panels, to minimize end joints.
        c. On partitions/walls 8'-1" or less in height apply gypsum board horizontally (perpendicular to framing); use maximum length sheets possible to minimize end joints.
    2. Single-Layer Fastening Methods: Apply gypsum boards to supports as follows:
        a. Fasten with screws

D. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
    1. Install gypsum backing board for base layer and gypsum wallboard for face layer.
    2. On ceilings apply base layer(s) prior to base layer application on walls/partitions; apply face layers in same sequence. Offset joints between layers at least 10-inches. Apply base layers at right angles to supports unless otherwise indicated.
    3. On partitions/walls apply base layer(s) and face layers vertically (parallel to framing) with joints of base layers over supports and face layer joints offset at least one stud or furring member space from base layer joints.

4. Multi-Layer Fastening Methods:
   a. Apply base layer(s) of gypsum board and face layer to base layer(s) as follows:
   b. Fasten both base layer(s) and face layer separately to supports with screws.

E. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

F. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
   1. Fasteners spaced approximately 8-inches o.c. and set back 3/8-inch minimum from edges and ends of boards.
   2. Cut boards at penetrations, edges and other obstructions of the work; fit tight against abutting work, except provide 3/8-inch setback where non-loadbearing work abuts structural elements at head and jambs.
   3. Coordinate installation of sheathing with installation of flashing and joint sealers so that these combined materials are installed in the sequence and manner which prevents exterior moisture from passing through complete exterior wall assembly to the interior.
   4. Apply fasteners so that screw heads bear tightly against face of gypsum sheathing boards but do not cut into face paper.
   5. Do not bridge building expansion joints with gypsum sheathing; cut and space edges to match spacing of structural support elements.

G. Fiber-Reinforced Gypsum Panels: Install in strict accordance with manufacturer's instructions.

H. Glass Mat Faced Gypsum Board: Install in strict accordance with manufacturer's instructions.

I. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

J. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For nonrated assemblies, install as follows:
   1. Single-Layer Applications: Adhesive application.
   2. Double-Layer Application: Install base layer using screws. Install face layer using adhesive.

K. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board with sealant.

3.07 INSTALLATION OF TRIM AND ACCESSORIES

A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges to comply with manufacturer's recommendations.

B. Control Joints: Place control joints consistent with lines of building spaces and as indicated on drawings.
   1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
   2. At exterior soffits, not more than 30 feet (10 meters) apart in both directions.
   3. Install control joints at spacings and locations required by referenced gypsum board application and finish standard, and approved by the Architect for visual effect.

C. Corner Beads: Install at external corners, using longest practical lengths.

D. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.08 JOINT TREATMENT

A. General: Apply treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects and elsewhere as required to prepare work for decoration.

B. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.

1. Joint tape and joint compound shall be compatible with waterproofing subsequently applied.

C. Paper Faced Gypsum Board: Use paper joint tape, embed with ready-mixed vinyl-based joint compound and finish with ready-mixed vinyl-based joint compound.

D. Fiber Reinforced Gypsum and Cement Board: Use alkali-resistant glass fiber tape, recommended by manufacturer, embedded in latex-fortified mortar or latex-based Type 1 mastic over the joint. Use same material as specified for tile setting.

E. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
2. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

F. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
2. Taping, filling, and sanding are not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
3. Taping, filling, and sanding are not required at base layer of double-layer applications.

G. Prefill open joints and rounded or beveled edges, if any, using setting-type joint compound.

H. Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.

I. Finish interior gypsum wallboard by applying the following joint compounds in 3 coats (not including prefill of openings in base), and sand between coats and after last coat:
1. Embedding and First Coat: Ready-mix drying-type all-purpose or taping compound.
2. Fill (Second) Coat: Ready-mix drying-type all-purpose or topping compound.
3. Finish (Third) Coat: Ready-mix drying-type all-purpose or topping compound.

J. Water-Resistant Gypsum Board and Exterior Gypsum Board: Finish joints between water-resistant backing board with tape and setting-type joint compound to comply with gypsum board manufacturer's written recommendations and installation standards referenced in related sections.

K. Vapor Barrier Joint Treatment: Install air and vapor barrier membrane in accordance with manufacturer's recommendations. Use rubber roller to insure tight seal against wall and between overlapped edges.

L. Partial Finishing: Omit third coat and sanding on concealed drywall construction which is indicated for drywall finishing, except where finishing is required to achieve fire-resistance rating, sound rating or to act as air or smoke barrier.

M. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
1. Option: Rapid Deco Level 5 System by Lafarge North America.

3.09 CLEANING AND PROTECTION OF WORK

A. Promptly remove any joint compound and adhesives and similar residue from adjacent surfaces, as it may occur.

B. Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum drywall construction remain without damage or deterioration at time of Substantial Completion.

3.10 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

3.11 FINISH LEVEL SCHEDULE

A. Level 1: Above finished ceilings concealed from view.

B. Level 2: Utility areas and areas behind cabinetry.

C. Level 3: Walls scheduled to receive textured wall finish.

D. Level 4: Walls and ceilings scheduled to receive flat or eggshell paint finish.

E. Level 5: Walls and ceilings scheduled to receive semi-gloss or gloss paint finish.

END OF SECTION

SECTION 09 3000
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Coated glass mat backer board as tile substrate.

D. Stone thresholds.

E. Ceramic trim.

F. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2024.

B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.

C. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2020.

D. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs; 2020.

E. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2024.

F. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.

G. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2025-2026.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches (457 by 457 mm) in size illustrating pattern, color variations, and grout joint size variations.

E. Certificate: Certify products of this section meet or exceed specified requirements.

F. Installer's qualification statement.

G. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Tile: 2 percent of each size, color, and surface finish combination, but not less than 10 square feet of each type.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

B. Installer Qualifications:
1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

PART 2 PRODUCTS

2.01 TILE

A. Porcelain Tile: Floor & Wall
1. Size: As indicated on drawings.
2. Color: As indicated on drawings.
3. Pattern: As indicated on drawings.
4. Products:

B. Natural Stone Tile:
1. Size: Random Mosaic
2. Edges: Square.
3. Products: See Finish Legend.

2.02 TRIM AND ACCESSORIES

A. Porcelain Trim: Matching bullnose ceramic shapes in sizes coordinated with field tile.
1. Applications:
a. Open Edges: Bullnose.
b. Inside Corners: Jointed.
c. Floor to Wall Joints: Cove base, unless indicated otherwise.
2. Manufacturers: Same as for tile.

B. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, set with tile mortar or adhesive.
1. Applications:
a. Open edges of reception desk tile.
b. Inside and outside wall corners.
c. Transition between floor finishes of different heights.
d. Thresholds at door openings.
e. Floor and wall expansion and control joints.
f. Floor-to-wall joints.
g. Borders and other trim as indicated on drawings.
2. Products:
a. Schluter-Systems; Designbase SL: www.schluter.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ADHESIVE MATERIALS

A. Manufacturers:
1. Bostik Inc: www.bostik-us.com.

2. Mapei Corporation: www.mapei.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Epoxy Adhesive: ANSI A118.3, thinset bond type.

C. Manufacturers:
1. Bostik, Inc: www.bostik-us.com.
2. Mapei Corporation: www.mapei.com.

D. Mortar Bed Materials: Portland cement, sand, latex additive, and water.

2.04 GROUTS

A. Grout: 100% solids epoxy grout as specified in ANSI A118.3 - 2005.
1. Colors: To be selected by Architect from manufacturer's full range.
2. Location: Floors in toilets, and elsewhere indicated.

2.05 THICK-BED MATERIALS

A. Mortar Bed Materials: Portland cement, sand, latex additive, and water.

2.06 ACCESSORY MATERIALS

A. Cleavage Membrane: No. 15 (6.9 kg) asphalt saturated felt.

B. Waterproofing Membrane: Equivalent to "ECB Anti-Fracture Membrane", as manufactured by NAC Products, Inc.; Cuyahoga Falls, Ohio (Phone: 1-800-633-4622).
1. Provide complete system, including substrate primer/sealer, 40-mil, two component, self-adhering membrane, and appropriate top-coat primer for the material(s) to be placed over the ECB system.
2. Locations for Use: Below all tile flooring, turned up 1-inch at all edges and concealed by base material, and turned down at least 2-inches into floor drains.
3. Completed membrane system is intended for waterproofing, and to bridge substrate joints within the limitations stated in manufacturer's current written product data.

C. Membrane at Walls: No. 15 (6.9 kg) asphalt saturated felt.

D. Mesh Tape: 2 inch (50 mm) wide self-adhesive fiberglass mesh tape.

E. Backer Board: Coated glass mat type complying with ASTM C1178/C1178M; inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder.

F. Mesh Tape: 2 inch (50 mm) wide self-adhesive fiberglass mesh tape.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive tile.

B. Verify wall surfaces are smooth and flat within tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Vacuum clean surfaces and damp clean.

B. Seal substrate surface cracks with filler.

C. Install cementitious backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to feather edge.

D. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108/A118/A136, manufacturer's instructions, and TCNA (HB) or TCNA (HB-GP) recommendations, as applicable.

B. Lay tile to pattern indicated on drawings. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Install thresholds where indicated on drawings.

H. Sound tile after setting. Replace hollow sounding units.

I. Keep control and expansion joints free of mortar, grout, and adhesive.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

K. Grout tile joints unless otherwise indicated. Use epoxy grout unless otherwise indicated.

L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCA Handbook Method F131, epoxy bond coat and grout, unless otherwise indicated.
   1. Use waterproofing membrane under all tile.
   2. Where waterproofing membrane is indicated, install in accordance with TCA Handbook Method F122, with epoxy bond coat and grout.

3.05 INSTALLATION - FLOORS - MORTAR BED METHODS

A. Over exterior concrete substrates, install in accordance with TCA F101, bonded, with grout as indicated in finish schedule on Drawings.

B. Over interior concrete substrates, install in accordance with TCNA (HB) Method F111, with cleavage membrane, unless otherwise indicated on drawings.
   1. Where waterproofing, cleavage, or crack isolation membrane is indicated on drawings, with standard grout or no mention of grout type, install in accordance with TCNA (HB) Method F121.
   2. Where epoxy bond coat and grout are indicated on drawings, install in accordance with TCNA (HB) Method F132, bonded.
   3. Where epoxy or furan grout is indicated on drawings, but not epoxy or furan bond coat, install in accordance with TCNA (HB) Method F114, with cleavage membrane.

C. Over wood substrates, install in accordance with TCNA (HB) Method F141, with standard grout, unless otherwise indicated on drawings.

D. Cleavage Membrane: Lap edges and ends.

E. Mortar Bed Thickness: 1-1/4 inch (31.8 mm), unless otherwise indicated.

3.06 INSTALLATION - WALL TILE

A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

B. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202 thin-set with epoxy bond coat and grout.

3.07 CLEANING

A. Clean tile and grout surfaces.

3.08 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

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SECTION 09 5100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

C. Supplementary insulation above ceiling.

1.02 RELATED REQUIREMENTS

A. Section 07 2100 - Thermal Insulation: Acoustical insulation.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019 (Reapproved 2025).

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2024a.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning and junctions with other ceiling finishes.

C. Product Data: Provide data on suspension system components and acoustical units.

D. Samples: Submit two samples 6 by 6 inch (____by____ mm) in size illustrating material and finish of acoustical units.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 5 percent of total installed (but not less than 100 SF) for each type of acoustical unit.

1.05 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:
   1. Acoustical Panels: Sagging and warping
   2. Grid System: Rusting and manufacturer's defects

B. Warranty Period:
   1. Acoustical panels: Ten (10) years from date of substantial completion.
   2. Grid: Ten (10) years from date of substantial completion.
   3. Acoustical panels and grid systems with HumiGuard Plus or HumiGuard Max performance supplied by one source manufacturer is Thirty (30) years from date of substantial completion.

4. Acoustical panels and grid systems with Humidity/Sag Resistant Treatment supplied by one source manufacturer shall be warranted for Thirty (30) years from date of substantial completion.
5. Acoustical panels and grid systems with Humidity/Sag Resistant Treatment supplied by one source manufacturer shall be warranted for number of years as indicated for each product, from date of substantial completion.
6. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.08 PROJECT CONDITIONS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Install acoustical units after interior wet work is dry.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.

B. USG Corporation: www.usg.com/ceilings/#sle.

C. Substitutions: See Section01 6000-Product Requirements.

2.02 ACOUSTICAL UNITS

A. Acoustical Panels:
   1. As indicated on Ceiling Finish Key.

2.03 SUSPENSION SYSTEMS

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold-down clips, stabilizer bars, clips, and splices as required.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch (2 mm) galvanized steel wire.

C. Perimeter Moldings: Same metal and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

D. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions, as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.

E. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

F. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.

J. Do not eccentrically load system or induce rotation of runners.

K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Install in bed of acoustical sealant.
   2. Use longest practical lengths.

L. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch (25 mm) movement. Maintain visual closure.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Lay directional patterned units with pattern parallel to longest room axis.

D. Fit border trim neatly against abutting surfaces.

E. Install units after above-ceiling work is complete.

F. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

G. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.
   3. Double cut and field paint exposed reveal edges.

H. Where round obstructions occur, provide preformed closures to match perimeter molding.

I. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

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SECTION 09 6500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

C. Installation accessories.

1.02 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

B. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2025.

C. ASTM F1700 - Standard Specification for Solid Vinyl Floor in Modular Format such as Tile(s) or Plank(s); 2025.

D. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021 (Reapproved 2025).

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Shop Drawings: Indicate seaming plans and floor patterns.

D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

E. Verification Samples: Submit two samples, 9 by 9 inch (___ by ___ mm) in size illustrating color and pattern for each resilient flooring product specified.

F. Concrete Testing Standard: Submit a copy of ASTM F710.

G. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.

H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: Provide minimum of 5% of each type and color.
   3. Extra Wall Base: Provide minimum of 5% of each type and color.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect roll materials from damage by storing on end.

1.05 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Luxury Vinyl Tile: LVT-1.
   1. Minimum Requirements: Comply with ASTM F1700, of Class III, Type B - Embossed Surface.
   2. Smoke Developed: 450 or less, when in accordance with ASTM E 662.
   3. Static Load Limit: 1500 psi, when tested in accordance with ASTM F 970 (modified).

4. Size: See Finish Legend.
5. Wear Layer Thickness: 0.022 inch (0.55 mm).
6. Total Thickness: 3/16 inch (4.5 mm).
7. Durability: 0.125 inch - Very Good.
8. Maintainability: 0.125 inch - Excellent.
9. Resilience: 0.125 inch - Excellent.
10. Manufacturer/ Style/ Color: See Finish Legend.

B. Luxury Vinyl Tile: LVT-2
1. Minimum Requirements: Comply with ASTM F1700, of Class III, Type B - Embossed Surface.
2. Static Load Limit: 1500 psi, when tested in accordance with ASTM F 970 (modified).
3. Size: See Finish Legend.
4. Wear Layer Thickness: 0.020 inch (0.50mm)
5. Manufacturer/ Style/ Color: See Finish Legend.

C. Feature Strips: Of same material as tile.

2.02 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
1. Height: See Finish Legend.
2. Thickness: 0.125 inch (3.2 mm).
3. Finish: As selected by Architect.
4. Length: Roll.
5. Accessories: Premolded external corners and end stops.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

C. Moldings, Transition and Edge Strips: Same material as flooring, except where indicated otherwise.

D. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

D. Verify that concrete sub-floor surfaces are dry enough and ready for resilient flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F710; obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

B. Prohibit traffic until filler is fully cured.

C. Clean substrate.

D. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:
   1. Spread only enough adhesive to permit installation of materials before initial set.
   2. Fit joints and butt seams tightly.
   3. Set flooring in place, press with heavy roller to attain full adhesion.

D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
   2. Resilient Strips: Attach to substrate using adhesive.

F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

G. Install flooring in recessed floor access covers, maintaining floor pattern.

H. At movable partitions, install flooring under partitions without interrupting floor pattern.

I. Install feature strips where indicated.

3.04 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.
   1. Apply protective floor polish to resilient flooring surfaces free from soil, excess adhesive or surface blemishes. Use commercially available, metal, cross-linked acrylic product acceptable to resilient flooring manufacturer.
      a. Coordinate selection of floor polish with Owner and/or their maintenance service.
      b. Buff floor tile and provide two (2) coats of a protective floor polish at or near the point of substantial completion.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

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SECTION 09 6813
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

A. Section 09 6500 - Resilient Flooring: Rubber base, and transition strips.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit three carpet tiles illustrating color and pattern design for each carpet color selected.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.05 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. See Finish Legend for Basis of Design products. Approved substitutions listed below, subject to physical sample of each product being approved by Architect:
   1. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Tile Carpeting: See Finish Legend for products.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips: Embossed aluminum, color as selected by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

C. Verify that concrete sub-floor surfaces are dry enough and ready for flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F710; obtain instructions if test results are not within limits recommended by carpet tile manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Locate change of color or pattern between rooms under door centerline.

G. Fully adhere carpet tile to substrate.

H. Trim carpet tile neatly at walls and around interruptions.

I. Complete installation of edge strips, concealing exposed edges.

3.04 PROTECTION

A. Protect installed carpet from damage from construction operations during the remainder of the construction period: use protection materials/methods indicated or recommended in writing by carpet manufacturer.

3.05 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 7200
WALL COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall covering.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Wall substrate.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets for wall covering and adhesive. Indicate compliance with specified flame spread and smoke developed ratings.

C. Shop Drawings: Indicate wall elevations with seaming layout.

D. Samples: Submit two samples of wall covering, 12 by 12 inch (____by____ mm) in size illustrating color, finish, and texture.

E. Manufacturer's Instructions: Indicate installation special procedures.

F. Maintenance Materials: Furnish the following for Owner's use in project maintenance:
   1. See Section 01 6000 - Product Requirements for additional provisions.
   2. Extra Stock Materials: 25 feet (8 m) of each color and pattern of wall covering.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with minimum 3 years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified, with minimum 3 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials for damage upon arrival.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

1.07 FIELD CONDITIONS

A. Maintain adhesive and wall covering manufacturer's recommended temperature ranges 24 hours before, during, and after installation.

PART 2 PRODUCTS

2.01 WALL COVERINGS

A. Performance Requirements:
   1. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 50, maximum, when tested in accordance with ASTM E84.
   2. Wall Covering shall be microvented, or perforated.

B. Wall Covering: Rigid vinyl panel.
   1. Panel Size: 4 by 8 feet (1.2 by 2.4 m).
   2. Rigid Vinyl Thickness: 40 mils, 0.040 inch (1.02 mm).
   3. Panel Edge Treatment: Square.
   4. Trim: Manufacturer's standard trim shapes; vinyl, match face panel color.
   5. Color: See Finish Legend.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify substrate surfaces are primed and meet manufacturer's requirements to receive work.

B. Measure moisture content of substrates with electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.

C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet (3 mm in 3 m) or at rate greater than 1/16 inch/ft (5 mm/m).

D. Notify Architect of detrimental conditions affecting wall covering installation.

E. Correct detrimental conditions before starting installation.

3.02 PREPARATION

A. Remove wall plates and accessories impeding wall covering installation.

B. Wash impervious surfaces with tetra-sodium phosphate; rinse and neutralize; wipe dry.

C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings before preparing surfaces or finishing.

D. Correct surface defects affecting work of this section and clean surfaces. Remove existing coatings exhibiting loose surface defects.

E. Vacuum surfaces to remove loose particles.

3.03 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall immediately before applying wall covering.

C. Use wall covering in roll number sequence.

D. Razor trim edges of wall covering. Do not razor trim on gypsum board surfaces.

E. Smoothly apply wall covering without wrinkles, gaps, or overlaps. Eliminate air pockets and ensure full bond to substrate surface.

F. Horizontal seams are not permitted.

G. Do not seam within 2 inches (51 mm) of internal corners or within 6 inches (152 mm) of external corners.

H. Install wall covering before installing bases and items attached to, abutting, or located within 1 inch (25 mm) of wall surface.

I. Do not install wall covering more than 1/4 inch (6 mm) below top of resilient base.

J. Cover spaces above and below windows and above doors in pattern sequence from roll.

K. Where wall covering tucks into reveals, metal wallboard, or plaster stops, use contact adhesive within 6 inches (152 mm) of wall covering termination. Ensure complete contact bond.

L. Install termination trim.

M. Remove excess adhesive from seams while wet and before proceeding to next wall covering sheet.

N. Reinstall wall plates and accessories removed to accommodate work of this section.

3.04 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

B. Clean wall coverings of dust, dirt, excess adhesive, and other contaminants.

3.05 PROTECTION

A. Protect installed products from damage until mm-dd-yyyy.

END OF SECTION

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SECTION 09 9100
PAINTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints and other coatings.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Exposed surfaces of steel lintels and ledge angles.
   3. Mechanical and Electrical:
      a. In all areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. In all areas, paint shop-primed items.
      c. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
      d. Paint dampers exposed behind louvers, grilles, to match face panels.

D. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Non-metallic roofing and flashing.
   6. Stainless steel, anodized aluminum, bronze, terne, and lead items.
   7. Marble, granite, slate, and other natural stones.
   8. Floors, unless specifically so indicated.
   9. Ceramic and other tiles.
   10. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
   11. Brick, and cast stone.
   12. Exterior insulation and finish system (EIFS).
   13. Glass.
   14. Acoustical materials, unless specifically so indicated.
   15. Concealed pipes, ducts, and conduits.
   16. Door hinges, hardware, or fire door labels.
   17. Rusty or corroded surfaces until sandblasted or wire-brushed free of corrosion, and wiped clean.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 04 2000 - Unit Masonry Assemblies: Faces to be painted in this section.

C. Section 05 5000 - Metal Fabrications: Shop-primed items.

D. Section 08 1113 - Steel Doors and Frames: Shop-primed steel doors and frames.

E. Section 09 2116 - Gypsum Board Assemblies.

F. Section 09 9600 - High-Performance Coatings.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2012.

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

1.04 DEFINITIONS

A. Conform to ASTM D 16 for interpretation of terms used in this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on all finishing products and special coatings, including VOC content.
   1. List each material and cross reference to scheduled paint types, and including each specific coating, finish system, and application. Identify each material by the manufacturer's catalog number and general classification.

C. Samples for initial color selection in the form of manufacturer's color charts from paint/coating manufacturer intended for use.

D. Samples: Submit two paper chip samples, 4x8 inch in size illustrating range of colors available for each surface finishing product scheduled.

E. Samples for verification purposes: Provide samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate. Define each separate coat, including fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.

F. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.

G. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

H. Applicator certifications that are required to be in writing.

I. Submit Manufacture Representative reports as outlined in Field Quality Control below.

J. Coating Maintenance Manual: Upon conclusion of the Project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as S-W "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product / color / finish was used, product data pages, Material Safety Data Sheet (MSDS), care and cleaning instructions, and Touch-up procedures.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

C. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by paint manufacturer, and use only within the recommended limits.

D. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Architect of any problems anticipated using the materials specified, prior to proceeding with work.

E. Material Quality: Provide the manufacturer's best quality grade paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
   1. Proprietary names used to designate colors or materials are not intended to imply that products named are required or to exclude approved equivalent products of other manufacturers.

F. Mock-Up: Provide mock-up at least 3 ft x 3 ft of general wall paint and trim for Architect's and Owner's review. Mock-Up guidelines as described in Section 01 4000 - Quality Requirements.

G. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

H. Lead content in pigments or other painting materials and components is not allowed.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame and smoke rating requirements for products and finishes.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, pigment and vehicle constituents by volume, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

D. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers, others present or passing through or inspecting work areas (painting or any other work), and the work areas themselves are protected from fire and health hazards resulting from handling, mixing, and application of materials.

1.09 PROJECT CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
   1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer, during application, drying and curing periods.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for solvent-thinned Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.10 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Supply 1 gallon of each color and type; store where directed.

C. Label each container with color, type, and room locations in addition to the manufacturer's label.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products from the same manufacturer to the greatest extent possible.

B. Paints:
   1. Sherwin-Williams [Basis of Design]: www.sherwin-williams.com.
   2. Benjamin Moore & Co: www.benjaminmoore.com.
   3. PPG Architectural Finishes, Inc: www.ppgaf.com.

C. Block Fillers: Same manufacturer as top coats.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
   1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
   4. Supply each coating material in quantity required to complete entire project's work from a single production run.
   5. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content:
   1. Provide coatings that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      b. Architectural coatings VOC limits of State in which the project is located.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

D. Colors: As indicated on drawings
   1. In all areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint CppE-OP-3A - Concrete, Poured and Precast:
   1. One Coat: S-W: Loxon Concrete & Masonry Primer, A24W8300, (<100 g/l voc).
   2. Two Coats: S-W: SuperPaint Acrylic Exterior House Paint (Flat, A80-100 series) (Satin, A89-100 Series) (Gloss, A84-100 Series) - Architect to select finish required (<50 g/l voc).

B. Paint CE-OP-3A - Masonry, Opaque, (One filler coat and two acrylic finish coats):
   1. One Coat: S-W: PrepRite Interior / Exterior Acrylic Block Filler, B25W25 (<50 g/l voc) (as required to be pinhole-free).
   2. Two Coats: S-W: SuperPaint Exterior Acrylic House Paint, Gloss, A84-100 Series (<50 g/l voc).

C. Paint GEfibcem-OP-3A - Fiber Cement Board, Acrylic Primer and Paint, 3 Coat:

1. One Coat: S-W: Loxon Latex Primer, A24 (if unprimed).
2. Two Coats: S-W: A100 Exterior Acrylic House Paint, A82. More coats if needed to cover all fibering. Sheen: As selected from gloss or satin.

D. Paint GE-OP-3A - Gypsum Board, Plaster & FRP, Opaque, Acrylic Primer and Paint, 3 Coat:
1. One Coat: S-W: Exterior Latex Primer, B42W8041 (<100 g/l voc).
2. Two Coats: S-W: SuperPaint Exterior Acrylic House Paint, Flat, A80-100 Series (<50 g/l voc).

E. Paint ME-OP-3A - Ferrous Metals, Unprimed, 100% Acrylic, 3 Coat:
1. One Coat: S-W: Pro Industrial Pro-Cryl Universal Metal Primer, B66-310 (<100 g/l voc).
2. Two Coats: S-W: Sher-Cryl High Performance Acrylic, Gloss, B66-300 (<200 g/l voc).

F. Paint ME-OP-2A - Ferrous Metals, Primed, Acrylic Latex, 2 Coat:
1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
2. Two Coats: S-W: Sher-Cryl High Performance Acrylic, Gloss, B66-100 (<200 g/l voc).

G. Paint MgE-OP-3A - Galvanized Metals, Acrylic, Opaque, 3 Coat:
1. One Coat: S-W: Pro Industrial Pro-Cryl Universal Metal Primer, B66-300 (<100 g/l voc).
2. Two Coats: S-W: Sher-Cryl High Performance Semi-Gloss, B66-350 (<200 g/l voc).

2.04 PAINT SYSTEMS - INTERIOR

A. Paint WI-OP-3A - Wood, Opaque, Acrylic Latex, 3 Coat:
1. One Coat: S-W: Multi-Purpose Interior / Exterior Latex Primer /Sealer, B51-450 Series (<50 g/l voc).
2. Two Coats: S-W: ProMar 200 Zero VOC Interior Latex EgShel Enamel, B20-2600 (0 g/l voc).

B. Paint WI-TR-VS - Wood, Transparent, Varnish, Stain:
1. Filler coat: S-W: As required.
2. One coat of stain; S-W: WoodClassics “250” Interior Wood Stain, A49-800 Series (<250 g/l voc). Option: S-W: MinWax “250” VOC Stain (<250 g/l voc).
3. One coat sealer; S-W: none required.
4. Two coats; S-W: WoodClassics Waterbased Polyurethane, A68 Series (<350 g/l voc). Option: MinWax Waterbased Polyurethane Varnish: Satin (710337), Semi-Gloss (710320), Gloss (710313) (<350 g/l voc).

C. Paint CppI-OP-3A - Concrete, Poured and Precast, Opaque, Acrylic, 3 coats.
1. One Coat: S-W: Loxon Concrete & Masonry Primer, A24W8300 (<100 g/l voc).
2. Two Coats: S-W: ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel, B31-2600 (0 g/l voc).

D. Paint CI-OP-3L - Masonry, Opaque, Latex, 3 Coat:
1. One Coat: S-W: Pro Industrial Heavy Duty Block Filler, B42W150. (Required to be pin-hole free).
2. Two Coats: ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel, B31-2600 (0 g/l voc).

E. Paint MI-OP-3A - Ferrous Metals, Unprimed, Acrylic, 3 Coat:
1. One Coat: S-W: Pro Industrial Pro-Cryl Universal Acrylic Primer, B66-310 (<100 g/l voc).
2. Two Coats: S-W: ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel, B31-2600 (0 g/l voc).

F. Paint MI-OP-2A - Ferrous Metals, Acrylic Primed, Acrylic-Alkyd Finish, 2 Coat:
1. One Coat: Touch up with primer: S-W: Pro Industrial Pro-Cryl Universal Acrylic Primer, B66-310 (<100 g/l voc).
2. Two Coats: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Semi-Gloss B34-8200 Series.

G. Paint MgI-OP-3A - Galvanized Metals, Acrylic, 3 Coat:
1. One Coat: S-W: Pro Industrial Pro-Cryl Universal Primer, B66-310 (<100 g/l voc).

2. Two Coats: S-W: ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel, B31-2600 (0 g/l voc).

H. Paint CI-OP-3E - Concrete/Masonry [Inside Face of Single-Wythe Exterior Concrete Block Walls, and in Rest Rooms and other Wet Areas], Epoxy Enamel, 3 Coat:
1. One Coat: S-W: Kem Cati-Coat HS Epoxy Filler Sealer, B42W400. (Required to be pin-hole free) (Trowel to smooth finish may be required).
2. Two coats of waterborne epoxy polyamide (two-component, chemically-cured waterborne epoxy coating for use as a high performance architectural coating). S-W: Pro Industrial Water Based Catalyzed Epoxy (B73-300, Gloss) or (B73-360 EgShel). Architect to select finish required.

I. Paint GI-OP-3E - Gypsum Board, Epoxy, 3 Coat:
1. One coat of best commercial grade acrylic drywall primer, or as recommended by paint manufacturer. S-W: ProMar 200 Zero VOC Interior Latex Primer, B28-2600 (0 g/l voc).
2. Semi-gloss: Two coats of S-W K46 Pro Industrial Precatalyzed Waterbased Epoxy. Scrub Resistance: 500-600 cycles per ASTM D 2486. MPI # 141, & 153, (145 g/L).

J. Paint GI-OP-3LA - Gypsum Board/Plaster, Latex-Acrylic, 3 Coat:
1. One Coat: S-W: ProMar 200 Zero VOC Interior Latex Primer, B28-2600 (0 g/l voc).
2. Two Coats: S-W: ProMar 200 Zero VOC Interior Latex EgShel, B20-2600 (0 g/l voc). (Where Sheen is indicated "Gloss", provide Pro Industrial™ High Performance Acrylic, B66-600 Series, <50 g/l voc).

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Gypsum Wallboard: 12 percent.
2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

E. All surfaces to be pinhole free.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

H. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

I. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

J. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-PC 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).

K. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

L. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

M. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

N. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

O. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Identify fire walls, smoke barriers, etc., in accessible concealed floor, floor-ceiling or attic spaces, by stenciling "X-HOUR FIRE AND/OR SMOKE BARRIER" in 3-inch high contrasting letters, 3/8-inch minimum stroke. Locate within 15 feet of end of wall, and at intervals not exceeding 30 feet measured horizontally along the wall or partition.

B. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

C. Apply products in accordance with manufacturer's instructions.

D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

F. Apply each coat to uniform appearance.

G. All surfaces shall be pinhole-free.

H. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

I. Sand wood and metal surfaces lightly between coats to achieve required finish.

J. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

K. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

L. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Refer to Division 23 and 26 Sections for scheduling of color coding of equipment, duct work, piping, and conduit.

B. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

C. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

B. Architect shall approve surface prior to finish coats being applied.

C. Manufacturers Representative shall visit the site a minimum of 3 times. These visits shall be at the beginning , middle and completion of work.
   1. The beginning visit shall review the substrate for compliance prior to installation and for appropriate use of products.
   2. The middle visit shall review the progress and performance of the installer.
   3. The final visit shall review the quality of the final product.
   4. The manufacturer shall submit reports to the Contractor and the Architect within 72 hours of each visit. The letter shall document observations, instructions to Contractor, and any remediations required and/or completed.

3.06 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean paint from all electrical devices, mechanical devices, door hardware, architectural items, and other permanent materials.

3.07 PROTECTION

A. Protect finished coatings until completion of project.

B. Touch-up damaged coatings after Substantial Completion.

3.08 SCHEDULE - SURFACES TO BE FINISHED

A. Paint the surfaces described in PART 2, Paint Systems Articles.

3.09 SCHEDULE - PAINT SYSTEMS

A. Concrete Block: Finish all surfaces exposed to view.
   1. Exterior: CE-OP-3A, gloss.
   2. Interior: CI-OP-3L, semi-gloss.
   3. Interior: CI-OP-3E, gloss, or egg shell; as selected, or scheduled.

B. Concrete, Poured and Precast: Finish all surfaces exposed to view, unless indicated otherwise.
   1. Exterior: CppE-OP-3A, select finish.
   2. Interior: CppI-OP-3A, semi-gloss.

C. Gypsum Board: Finish all surfaces exposed to view.
   1. Exterior, FRP, Urethane: GE-OP-3A, flat.
   2. Exterior, Glass mat faced soffit: GEsof-OP-3A, satin.
   3. Interior Walls and Gyp Bd Ceilings in Wet Areas: GI-OP-3E, Semi-gloss.
   4. Interior Ceilings and Walls: GI-OP-3LA, eggshell (Except gloss, where indicated).

D. Wood: Finish all surfaces exposed to view.
   1. Interior trim and frames: WI-OP-3A, eggshell.
   2. Interior trim: WI-TR-VS, satin, semi-gloss, gloss.

E. Steel Doors and Frames: Finish all surfaces exposed to view.
   1. Exterior: ME-OP-2A, gloss.
   2. Interior: MI-OP-2A, semi-gloss.

F. Steel Fabrications: Finish all surfaces exposed to view.
   1. Exterior: ME-OP-3A, gloss; finish all surfaces, including concealed surfaces, before installation.
   2. Interior: MI-OP-3A, semi-gloss.

G. Galvanized Steel: Finish all surfaces exposed to view.
   1. Exterior: MgE-OP-3A, semi-gloss.
   2. Interior: MgI-OP-3A, semi-gloss.

END OF SECTION

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SECTION 09 9600
HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High performance coatings.
   1. Coatings for Exterior Use: 3-coat high performance system.

B. Surface preparation.

1.02 RELATED REQUIREMENTS

A. Division 5 - Structural & Miscellaneous Steel.

B. Section 09 9100 - Painting: Requirements for mechanical and electrical equipment surfaces.

1.03 REFERENCE STANDARDS

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

B. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

C. SSPC-SP 11 - Power-Tool Cleaning to Bare Metal; 2020.

1.04 DEFINITIONS

A. Coatings: Paint or heavy duty finishes for use on surfaces subject to interior and exterior exposure, submergence, high moisture, splash, or chemical environment, including primers, sealers, fillers, and intermediate and finish coats.

B. Normal: Surfaces subject to normal temperature and humidity.

C. First Coat: Field primer, factory primer, or shop primer. When only one coat is required, first coat is the finish coat.

D. Second, Third, Intermediate, or Finish coats: Successive finish coats applied over first coat.

E. DFT: Dry Film Thickness (Mils/coat).

F. Sfpg: Square feet per gallon (per coat).

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating coating materials.
   1. Manufacturer's literature including application recommendations and generic makeup for each coating scheduled.
   2. List each material and cross-reference the specific coating, finish system, and application.
   3. Submit one copy of manufacturer's Material Safety Data Sheets (MSDS) for each type of coating to Architect.
   4. Post copy of MSDS on the Site at all times when coating is in progress.

C. Samples: Submit two samples 8 by 8 inch (203 by 203 mm) in size illustrating colors available for selection.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Maintenance Data: Include cleaning procedures and repair and patching techniques.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Coating Materials: 1 gallon (4 liters) of each type and color.
   2. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.06 QUALITY ASSURANCE

A. Regulatory Requirements: All coatings shall conform to OSHA requirements for allowable exposure to lead and other hazardous substances.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

D. Single-Source Responsibility: Provide coating material produced by the same manufacturer for each system.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to the site in original containers with labels intact and seals unbroken.

B. Protect and heat or cool material storage location to maintain temperature ranges recommended by coating manufacturers, but not less than 50 degrees F.

C. Oily rags and waste must be removed from buildings each night or kept in appropriate metal containers. Provide fire extinguishers of the type recommended by coating manufacturers in areas of storage and where finishing is occurring. Allow no smoking or open containers of solvent.

D. Empty containers shall have labels canceled and clearly marked as to use.

1.08 FIELD CONDITIONS

A. Environmental Requirements:
   1. Relative humidity conditions as specified by coating manufacturer shall be adhered to.
   2. Do not apply exterior coating when cold damp, foggy, or rainy weather appears probable, or when the temperature of the substrate is below 50 degrees F., unless approved in writing by the coating manufacturer.
   3. Maintain the manufacturer's environmental requirements until the coating is fully cured.
   4. Apply no coating in areas where dust is being generated.
   5. Restrict traffic from area where coating is being applied or is curing.

B. Protection:
   1. Drop cloths shall be provided in all areas where coating is performed to fully protect other surfaces.
   2. Remove hardware, accessories, plates, lighting fixtures, and similar items or provide protection by masking. Upon completion, replace items or remove protection and clean.

C. Upon substantial completion, remaining unused material will become property of the Owner. Seal material as required for storage, mark contents with color, type, location, and shelf life, and store on Site where required by Owner.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Manufacturer's Warranty: Manufacturer shall provide a 15-year color and gloss warranty that shall conform to the warranty offered by Basis-of-Design manufacturer.

D. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. High-Performance Coatings:
   1. Tnemec Company, Inc: www.tnemec.com/#sle.
   2. Substitutions: Section 01 6000 - Product Requirements.
      a. Each request for substitution shall include the name of the specified material for which a substitute is being requested; name of the proposed substitute material; and a complete description of the proposed substitute including performance and test data, cure times, recoat windows, and generic composition. No request for

substitution will be considered that would decrease film thickness or offer a change in the generic type of coating specified.

b. Substitution requests shall be received by the Architect no later than 10 days prior to bid date.

2.02 SYSTEM DESCRIPTION

A. Coating System for Exterior: Coating on Steel Frame at Portecochere structure.
   1. Exterior Exposed Ferrous Metals (Including Shop-primed Coat, Field-applied Intermediate Coat and Finish Coat):
      a. Surface Preparation: SSPC SP-6 Commercial Blast Cleaning. Angular surface profile shall be 1.5 - 2.0 mils.
      b. Primer/Shop Coat: Organic Zinc-Rich Urethane Primer.
         1) Dry Film Thickness: 2.5 - 3.5 mils.
         2) Product: Tnemec Series 90-97 Tneme-Zinc Exterior Primer.
      c. Intermediate Coat:
         1) Dry Film Thickness: 3.0 - 5.0 mils.
         2) Product: Tnemec Series 66 Hi-Build Epoxoline.
      d. Finish Coat:
         1) Dry Film Thickness: 2.0 - 3.0 mils.
         2) Product: Tnemec Series 73 Endura-Shield.
      e. Total Dry Film Thickness: 7.5 - 11.5 mils.
         1) Scheduled thickness or coverage rate is the minimum recommended by Tnemec Company, Inc. If another manufacturer is used, manufacturer's recommendations shall be followed, but in no case shall the thickness or coverage rate be less than scheduled.

2.03 COLORS, MIXING, AND THINNING

A. Color shall be formed by pigments free of lead, lead compounds, or other materials that might be affected by the presence of hydrogen sulfide or other gases likely to be present at the Site.

B. Where thinning is necessary, only the products of the manufacturer furnishing the coating will be allowed. All such thinning shall be done in strict accordance with the coating manufacturer's recommendations.

C. Mix in accordance with the manufacturer's recommendations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not begin application of coatings until substrates have been properly prepared.

C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

3.02 FIELD QUALITY CONTROL/JOB STANDARDS

A. Prior to commencing the installation, the contractor shall install, with the owner's approval, a mutually agreed upon test sample to show final color and texture of the system. This test area shall serve as a job standard for the final installation.

3.03 PREPARATION

A. Clean surfaces of loose foreign matter.

B. Applicator must report, in writing, surfaces left in improper condition by other trades. Application will constitute acceptance of surfaces by applicator.

C. Prepare surfaces as required, per manufacturer's printed instructions.

D. Where surface dryness is questioned, test with a dampness-indicating instrument. Do not apply coatings over surfaces where moisture content exceeds that permitted by the coating manufacturer.

E. Remove finish hardware, fixture covers, and accessories and store.

F. Ferrous Metal:
   1. Ferrous metal unprimed or shop-primed with an incompatible primer shall be abrasive blast cleaned prior to the application of a primer. Blast cleaning shall conform to SSPC-SP6 for all ferrous surfaces to be coated with a high performance system.
   2. Ferrous metal previously primed or coated with the specified primer shall be cleaned in accordance to SSPC-SP11 for damaged areas and touch-up. Surface cleaning shall include solvent cleaning to remove soluble contaminants. Where the existing applied coating is of unknown origin, a test patch shall be applied to confirm compatibility with the scheduled coating.

3.04 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Ferrous structural steel shall be shop-primed. Field touch-up, where necessary, shall consist of surface preparation specified in Preparation paragraph.

3.05 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in MPI - Architectural Painting and Specification Manual.

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

C. Surfaces shall be dry at time of application.

D. The minimum surface temperature shall be 50 degrees F and rising unless noted otherwise.

E. Apply in strict accordance to the manufacturer's recommendations by brush, roller, spray or other application method. The number of coats and thickness required is the same regardless of application method.

F. Each coat shall be allowed to dry in accordance to the manufacturer's requirements. Drying time shall be construed to mean "under normal conditions". Where conditions other than normal exist, because of weather or because of confined space, longer times will be necessary.

G. Coatings shall be applied to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, or other surface imperfections will not be acceptable. Areas cut-in by brush prior to rolling shall have uniform appearance in comparison to adjoining surfaces.

H. Edges of coatings adjoining other materials or other colors shall be sharp and clean without overlapping.

I. Crevices and other hard to apply areas shall be back-rolled/back-brushed in conjunction with the prime coat.

J. Where multiple coats of the same material are applied, each undercoat shall be slightly different in shade to facilitate identifying each coat.

3.06 FINAL TOUCH-UP

A. Prior to substantial completion, examine the coated surfaces and retouch or refinish surfaces to leave in condition acceptable to the Architect.

3.07 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. Remove masking, coatings, and other material from floors, glass, and other surfaces not scheduled to be coated.

D. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

E. Leave work areas in clean condition.

3.08 PROTECTION

A. Protect the completed work from water, airborne particles or other surface contaminants for a minimum of 24 hours after application.

B. Protect from traffic, physical abuse, immersion and chemical exposure for 24 hours at 75 degrees F. For different temperatures, consult the manufacturer's representative for curing times.

END OF SECTION

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SECTION 10 1100
VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related work specified elsewhere includes:
   1. Section 04 2000 - Unit Masonry.
   2. Section 06 1000 - Rough Carpentry: Wood blocking.
   3. Section 09 2116 - Gypsum Board Assemblies.

1.02 SUMMARY:

A. This Section includes the following types of factory-built visual display boards:
   1. Porcelain Enamel Steel Finish Markerboards.
   2. Vinyl covered cork tackboards.
   3. Anodized aluminum trim systems and accessories.
   4. Glass enclosed tack boards.

B. All markerboards and tackboards shall be 4'-0" in height by lengths indicated on the Drawings.

1.03 SUBMITTALS:

A. General: Submit the following in accordance with Conditions of the Contract and Division 1 Specification Sections.
   1. Product Data: Include manufacturer's data substantiating that tackboard materials comply with requirements indicated.
   2. Shop Drawings: Provide shop drawings for each type of markerboard, and tackboard required. Include sections of typical trim members and dimensioned elevations. Show anchors, grounds, reinforcement, accessories, layout, and installation details.
   3. Samples: Provide the following samples of each product for selection of colors, patterns, and textures, as required, and for verification of compliance with requirements indicated.
      a. Markerboards: Manufacturer's standard color charts consisting of actual sections of markerboard material and finish required, and where colors are not pre-selected, also showing the full range of colors available for each type of markerboard required.
      b. Tackboards: Manufacturer's standard color charts consisting of actual sections of tackboard material and finish required, and where colors are not pre-selected, also showing the full range of colors, textures, and patterns available for each type of cork tackboard indicated.
      c. Aluminum Trim and Accessories: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4-inch squares of sheet or plate, showing the full range of colors available, or pre-selected colors. Where finishes involve normal finish, texture, and/or color variations, include sets showing the full range of variations expected.
   4. Certificates: In lieu of laboratory test reports, when permitted by the Architect, submit the manufacturer's certification that cork tackboard materials furnished comply with requirements specified for flame spread ratings.
   5. Warranty: Provide manufacturer's sample warranty for each product proposed to be furnished. Upon acceptance, furnish actual executed warranty to the Contractor for submittal with Project Closeout Documents.

1.04 QUALITY ASSURANCE:

A. Fire Performance Characteristics: Provide tackboards with surface burning characteristics indicated below, as determined by testing assembled materials composed of facings and backings identical to those required in this section, in accordance with ASTM E 84, by a testing organization acceptable to authorities having jurisdiction.

1. Flame Spread: 25 or less.
2. Smoke Developed: 10 or less.

B. Design Criteria: The drawings indicate size, profiles, and dimensional requirements of visual display boards and are based on the specific type and model indicated.
   1. Substitutions: Other visual display boards having equivalent performance characteristics by other manufacturers may be considered provided that deviations in dimensions and profiles are minor and do not change the design concept or intended performance as judged by the Architect. The burden of proof of equality is on the proposer.
   2. Refer to Section 01 0150 - "Special Conditions", for requirements and time limits for submitting requests for substitutions.

C. Toxin-Free: Provide tackboard and markerboard products and assemblies which are free of any toxins, asbestos, harmful by-products, and carcinogens, including in part, all adhesives and glues.
   1. Tackboards shall be in compliance with Military Specification MIL-C-15116-C, Type II.

D. Single Source Responsibility: Provide all markerboards, tackboards, trim, and accessories by one manufacturer for the entire project, unless otherwise accepted by Architect in writing.

1.05 PROJECT CONDITIONS:

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting; Coordinate with the work of other trades. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.
   1. Allow for trimming and fitting wherever taking field measurements before fabrication might delay the Work.

1.06 WARRANTY:

A. Provide manufacturer's standard written warranty for each markerboard and tackboard product furnished.

PART 2 - PRODUCTS

2.01 MANUFACTURERS/PRODUCTS:

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
   1. Porcelain Enamel Steel Finish Markerboards:
      a. American Visual Display Products, LLC.
      b. Best-Rite Chalkboard Co.
      c. Carolina Chalkboard Co.
      d. Claridge Products and Equipment, Inc.
      e. Greensteel, Inc.
      f. Lemco, Inc.
      g. Marsh Chalkboard Co.
      h. Nelson Adams Co.
      i. Newline Products, Inc. (501) 472-2479
      j. Platinum Visual Systems (800) 498-2990
   2. Tackboards:
      a. American Visual Display Products, LLC.
      b. Best-Rite Chalkboard Co.
      c. Carolina Chalkboard Co.
      d. Claridge Products and Equipment, Inc.
      e. Greensteel, Inc.
      f. Lemco, Inc.
      g. Marsh Chalkboard Co.
      h. Nelson Adams Co.

i. Newline Products, Inc. (501) 472-2479
j. Platinum Visual Systems (800) 498-2990

B. Products: Subject to compliance with requirements, provide equivalent to the following products by one of the above named manufacturers.
1. Porcelain Enamel Steel Finish Markerboards (24-gage; color: White):
a. Equivalent to Claridge Products and Equipment, Inc.; "LCS."
2. Tackboards (color as selected):
a. Vinyl fabric on cork underlay with 1/4” hardboard backing. Equivalent to Claridge Products and Equipment, Inc.; "Fabricork #1380".
3. Aluminum Trim and Accessories (color as selected):
a. Equivalent to Claridge Products and Equipment, Inc.; "Series 1."
4. Glass Enclosed Tack Board:
a. Equivalent to Excel Series Indoor Enclosed Bulletin Board, as marketed by US Markerboard, sized as indicated, satin aluminum frame finish, shatter-resistant glass, lockable doors.
5. Equivalent Products by those manufacturers named above, and/or other manufacturers properly submitted (refer to Section 01 0150 - “Special Conditions”) at least 10 days prior to original Bid Date and subsequently accepted by Architect in writing or by Addendum will be acceptable.
6. Colors: As selected by Architect.
7. Sizes: Refer to Drawings.

2.02 MATERIALS:

A. Tackboard Core: Provide the manufacturer's standard 1/4-inch-thick tempered hardboard core material.

B. Markerboard Core: Provide the manufacturer's standard 1/2-inch thick particle board material.

C. Backing Sheet: Provide the manufacturer's standard 0.005-inch thick aluminum foil backing.

D. Laminating Adhesive: Provide the manufacturer's standard moisture-resistant thermoplastic-type adhesive.

E. Porcelain Enamel Steel Finish Markerboards: Provide 1/2-inch-thick particle board panel surfaced with the manufacturer's 24-gage steel sheet and porcelain enamel finish formulated for matte marker-receptive finish and for use of magnetic devices.
1. Provide with 0.005-inch thick aluminum foil backing.

2.03 ACCESSORIES:

A. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062-inch-thick aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units wherever possible; keep joints to a minimum. Miter corners to a neat, hairline closure.

B. Marker/Chalktray: Furnish manufacturer's standard continuous box-type aluminum marker/chalktray with slanted front and cast aluminum end closures for each markerboard.

2.04 FABRICATION:

A. Assembly: Provide factory-assembled markerboard and tackboard units, except where field-assembled units are required.
1. Make joints only where total length exceeds maximum manufactured length. Fabricate with the minimum number of joints, balanced around the center of the board, as acceptable to the Architect.
2. Provide manufacturer's standard mullion trim at joints between contiguous markerboard and tackboard.

2.05 FINISHES:

A. General: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Class II Clear Anodized Finish: AA-M12C22A31 (Mechanical Finish: as fabricated, nonspecular; Chemical Finish: etched, medium matte; Anodic Coating: Class II Architectural, clear film thicker than 0.4 mil).
   1. Provide color anodized in lieu of clear, upon request by Architect.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Deliver factory-built markerboard and tackboard units completely assembled in one piece without joints, wherever possible. Where dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to the Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.

B. Install units in locations and at mounting heights indicated and in accordance with the manufacturer's instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for a complete installation.
   1. Mounting Height: Top of markerboard and tackboard units shall align and be at 7'-0" above finished floor, unless otherwise indicated.

3.02 ADJUST AND CLEAN:

A. Verify that accessories required for each unit have been properly installed and that operating units function properly.

B. Clean units in accordance with the manufacturer's instructions. Break in markerboards only if and as recommended by the manufacturer.

END OF SECTION

SECTION 10 1400
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cash allowance for signs.

B. Room and door signs.

C. Interior directional and informational signs.

D. Emergency evacuation maps.

E. Building identification signs.

F. Plaque.

1.02 RELATED REQUIREMENTS

A. Section 01 2100 - Allowances.

B. Section 04 2000 - Unit Masonry.

C. Section 09 2116 - Gypsum Board Assemblies.

D. Division 22 Section - Identification for Plumbing Piping and Equipment.

E. Division 26 Section - Identification for Electrical Systems.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2100 - Allowances, for cash allowances affecting this section.

1.04 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.

1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
3. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

F. Verification Samples: Submit samples showing colors specified.

G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Curved Sign Media Suction Cups: Two; for removing media.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.08 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs:
1. Best Sign Systems, Inc: www.bestsigns.com/#sle.
2. Mohawk Sign Systems, Inc: www.mohawksign.com/#sle.
3. Seton Identification Products: www.seton.com/aec/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Curved Signs:
1. Vista System; V200 Series: www.vistasystem.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

C. Dimensional Letter Signs:
1. Leeds Architectural Letters, Inc.
2. Substitutions: See Section 01 6000 - Product Requirements.

D. Plaques:
1. Leeds Architectural Letters, Inc.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. All Signage Types: Unless otherwise indicated:
1. Character Font: Block lettering, sans serif, as selected.
2. Character Case: Upper and lower case (title case).
3. Background Color: As indicated on drawings, or as selected.
4. Character Color: Contrasting or as noted.

C. Interior Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
1. Sign Type: Curved signs with engraved panel media as specified.
2. Provide "tactile" signage, with letters raised minimum 1/32 inch (0.8 mm) and Grade II braille.
3. Use ADA Insert Panel, as specified.
4. Character Height: 1 inch (25 mm).
5. Sign Height: 6 inches (150 mm), unless otherwise indicated.
6. Sign Width: 8 inches, unless otherwise indicated.

7. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings.
8. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings.
9. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings. Sign sizes: 4" x 8", unless indicated otherwise.
10. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", as indicated on drawings, room numbers to be determined later, and braille.
11. Transparent Insert: Printable on common ink-jet or laser printer. Provide one (1) printed insert per sign based on occupant list to be provided at later date. Provide one (1) extra blank insert per door.
12. Opaque Insert: Provide up to six (6) options for background graphic design based on color and direction to be provided by Architect at later date.

D. Exterior: Flat panel, satin aluminum metal background, with black lettering. Sign size: 6" x 8".

E. Interior Directional and Informational Signs:
1. Sign Type: Same as room and door signs.
2. Sizes: As indicated on drawings.
3. Where suspended, ceiling mounted, or projecting from wall signs are indicated, provide two-sided signs with same information on both sides.

F. Emergency Evacuation Maps:
1. Allow for maps at locations indicated.
2. Map content to be provided by Owner.
3. Use clear plastic panel silk-screened on reverse, in brushed aluminum frame, screw-mounted.

G. Building Identification Signs:
1. Use individual metal letters.
2. Mount on outside wall in location indicated on drawings.

H. Plaque: At inside of entrance as directed by Architect.

2.03 SIGN TYPES

A. Flat Signs: Signage media without frame.
1. Edges: Square.
2. Corners: Square.
3. Clear Cover: For customer produced sign media, provide clear cover of polycarbonate plastic, glossy on back, non-glare on front.
4. Wall Mounting of One-Sided Signs: Tape adhesive.
5. Wall and Ceiling Mounting of Two-Sided Signs: Aluminum wall bracket, powder coated, color selected from manufacturer's standard colors, attached with screws in predrilled mounting holes, set in clear silicone sealant.
6. Suspended Mounting: Stainless steel suspension cables, cable clamps, and ceiling fastener suitable for attachment to ceiling construction indicated.

B. Radius / Curved Signs: One-piece, curved extruded aluminum media holder securing flat, flexible sign media by curved lip on two sides; other two sides closed by end caps; concealed mounting attachment.
1. Sizes: As indicated on drawings.
2. Finish: Natural (clear) anodized.
3. Sign Orientation: Curved in horizontal section.
4. End Caps: Aluminum with finish matching frame and stainless steel screw attachment.
5. ADA Insert - Clear, non-glare plastic lens with permanently affixed raised letters and braille. Size and thickness: As recommended by manufacturer.
6. Wall Mounting of One-Sided Signs: Mechanical anchorage, with predrilled holes, and set in clear silicone sealant.

7. Wall and Ceiling Mounting of Two-Sided Signs: Aluminum wall bracket, powder coated, color selected from manufacturer's standard colors, attached with screws in predrilled mounting holes, set in clear silicone sealant.
8. Suspended Mounting: Stainless steel suspension cables, cable clamps, and ceiling fastener suitable for attachment to ceiling construction indicated.

C. Radius / Curved Signs: One-piece, curved extruded aluminum media holder securing flat, flexible sign media by curved lip on two sides; other two sides closed by end caps; concealed mounting attachment.
1. Size: As specified, unless otherwise indicated.
2. Finish: Natural (clear) anodized.
3. Sign Orientation: Curved in horizontal section.
4. End Caps: Aluminum with finish matching frame and stainless steel screw attachment.
5. ADA Insert - Clear, non-glare plastic lens with permanently affixed raised letters and braille. Size and thickness: As recommended by manufacturer.
6. Wall Mounting of One-Sided Signs: Mechanical anchorage, with predrilled holes, and set in clear silicone sealant.
7. Wall and Ceiling Mounting of Two-Sided Signs: Aluminum wall bracket, powder coated, color selected from manufacturer's standard colors, attached with screws in predrilled mounting holes, set in clear silicone sealant.
8. Suspended Mounting: Stainless steel suspension cables, cable clamps, and ceiling fastener suitable for attachment to ceiling construction indicated.

D. Color and Font: Unless otherwise indicated:
1. Character Font: Helvetica, Arial, or other sans serif font.
2. Character Case: Upper case only.
3. Background Color: Clear.
4. Character Color: Contrasting color, to be selected by Architect.

2.04 TACTILE SIGNAGE MEDIA

A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
1. Total Thickness: 1/16 inch (1.6 mm).
2. Panel Edges: Square.
3. Panel Corners: Square.

2.05 NON-TACTILE SIGNAGE MEDIA

A. Silk Screened Plastic Panels: Letters and graphics silk screened onto reverse side of plastic surface:
1. Sign Color: Clear.
2. Total Thickness: 1/8 inch (3 mm).

2.06 PLAQUES

A. Metal Plaques: As detailed in Conditions of Contract.
1. Metal: Aluminum casting.
2. Casting shall be free from pits, scale, sand holes, or other defects.
3. Hand-tool and buff borders and raised copy to produce manufacturer's standard satin polished finish.
4. Background Finish: Provide dark statuary finish (Kynar 500).
5. Background Texture: Manufacturer's standard sand texture, or as selected.
6. Back of Plaque: Seal with manufacturer's standard clear, transparent, and non-yellowing lacquer, or similar finish with same characteristics and acceptable to Architect; two coats minimum.

2.07 DIMENSIONAL LETTERS

A. Metal Letters: Height and size as indicated on drawings. Letters shall be cut or cast from aluminum and finished with two (2) coats of baked enamel finish. Color to be selected by Architect.
   1. Font: As selected by Architect, in vector-based art file, with approval of Owner.
   2. Mounting: Concealed screws. Threaded stud with 3-inch offset spacers. Mounting template designating stud locations is required for all mounting surfaces. At cementitious cladding system, mount studs through cladding panel and into steel blocking.
   3. Ensure substrate material warranties are not impacted by sign installation.

B. Locations and Sizes of Letters:
   1. As indicated on drawings.

2.08 ACCESSORIES

A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

B. Tape Adhesive: Double sided tape, permanent adhesive.

C. Use clear, silicone sealant.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs where indicated:
   1. Mechanically fasten to CMU or gypsum board. Adhesive tape is not approved or acceptable.

D. Cast Metal Plaques: Mount plaque using the standard method recommended by the manufacturer for the type of wall surface indicated.
   1. Concealed Mounting: Mount the plaque by inserting threaded studs into tapped lugs on the back of the plaque. Set in pre-drilled holes filled with quick-setting cement.

E. Building Lettering: Mount letters onto building using the standard method recommended by the manufacturer for the type of surface indicated.
   1. Concealed Mounting: Unless recommended otherwise by manufacturer, mount the letters by inserting threaded studs into tapped lugs on the back of the letters. Set in pre-drilled holes filled with quick-setting cement. At cementitious cladding system, mount studs through cladding panel and into steel blocking.

3.03 PROTECTION

A. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION

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SECTION 10 2113.17
PHENOLIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Phenolic toilet compartments.

B. Urinal screens.

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry: Compartment wall & screen construction.

B. Section 06 1000 - Rough Carpentry: Blocking and supports.

C. Section 09 2116 - Gypsum Board Assemblies: Wall construction.

D. Section 10 2800 - Toilet Accessories.

1.03 REFERENCE STANDARDS

A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

D. Samples: Submit two samples of partition panels, 6 by 6 inch (____by____ mm) in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Phenolic Toilet Compartments:
   1. ASI Accurate Partitions; _____: www.asi-accuratepartitions.com/#sle.
   2. Ampco Products, Inc: www.ampco.com.
   3. Atlanta Sunbelt Products: www.atlantasunbelt.com.
   4. Columbia Partitions by PSISC: www.psisc.com.
   5. Scranton Products (Santana/Comtec/Capital): www.scrantonproducts.com.
   6. Substitutions: Section 01 6000 - Product Requirements.

2.02 COMPONENTS

A. Toilet Compartments: Solid Phenolic panels, doors, and pilasters, floor-mounted headrail-braced unless indicated otherwise.
   1. Color: To be selected from manufacturer's full range of Phenolic colors.

B. Door and Panel Dimensions:
   1. Thickness: 3/4 inch, minimum.
   2. Door Width: 24 inch (610 mm) unless indicated otherwise.
   3. Door Width for Handicapped Use: 36 inch (915 mm), out-swinging.
   4. Height: 58 inch (1 473 mm).
   5. Thickness of Pilasters: 3/4 inch, minimum.
   6. Urinal Screens: Wall-mounted with one continuous bracket.

2.03 ACCESSORIES

A. Pilaster Shoes: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 3 inch (76 mm) high, concealing ceiling fastenings.
   1. Provide ceiling attachment using two adjustable hanging studs, attached to above-ceiling framing.

B. Head Rails: Hollow stainless steel, 1 inch by 1 inch (25 mm by 25 mm) size, with anti-grip profile and cast socket wall brackets.

C. Pilaster Brackets: Satin stainless steel; manufacturer's standard type for conditions indicated on drawings.

D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.

E. Hardware: Satin stainless steel:
   1. Hinge: 14 gauge continuous.
   2. Nylon bearings.
   3. Door Latch: Slide type with exterior emergency access feature.
   4. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   5. Coat hook with rubber bumper; one per compartment, mounted on door.
   6. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch (9 mm to 13 mm) space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch (6 mm).

B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 2600
WALL PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Protective Wallcovering

1.02 SUBMITTALS

A. Comply with requirements of Section 01 3300 – Submittals.

B. Product Data: Submit manufacturer's product data including installation instructions.

C. Samples: Submit 7" x 9" sample of each type, thickness, color, and texture to be installed for Architect's approval.

D. Certification: Submit manufacturer's certification indicating Protective Wallcovering meets specified requirements.

E. Maintenance Instructions: Submit manufacturer's maintenance instructions for Protective Wallcoverings.

1.03 QUALITY ASSURANCE

A. Provide Protective Wallcovering that conforms to applicable codes including IBC, UBC, SBCCI, BOCA, Life Safety, and CA01350.

B. Installer Qualifications: Use installer experienced in the installation of Protective Wallcovering on projects of similar size and complexity.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacture's original unopened containers and packaging with labels clearly indicating manufacturer and material.

B. Storage:
   1. Store materials indoors in a clean, dry area protected from damage and in accordance with manufacturer's instructions.
   2. Maintain storage temperature above 50°F (10°C).
   3. Store materials flat. Do not stand rolls or sheet on end.

C. Handling: Protect materials during handling and installation to prevent damage.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain constant minimum air temperature of 65°F (18°C) for a minimum of 48 hours before and during installation.

B. Maintain wall temperature between 65°F (18°C) and 85°F (29°C) during installation.

C. Do not expose walls to direct sunlight during or after installation.

D. Do not install if relative humidity is greater than 80%.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Koroseal Wall Protection Systems; Korogard (Basis of Design): www.koroseal.com.

B. Substitutions: See Section 01 6000

2.02 PROTECTIVE WALLCOVERING

A. Fire Rating: Class A

B. Thickness: 0.040"

C. Color: As selected by Architect from manufacturer's standard colors.

2.03 ADHESIVES

A. Furnish adhesives approved by Protective Wallcovering manufacturer.

2.04 ACCESSORIES

A. Accessory Moldings: Furnish accessory moldings by Protective Wallcovering manufacturer to ensure accurate match of colors, dimensions, and physical properties.

B. Caulk: Furnish color matched caulk by Protective Wallcovering manufacturer to ensure accurate match of colors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect wall surfaces to receive Protective Wallcovering. Notify the Architect in writing if wall surfaces are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Prepare walls in accordance with manufacturer's written instructions.

B. Remove dust, dirt, grease, oil, loose paint, scale, and existing wallcovering.

C. Resurface uneven wall surfaces and damaged walls.

D. Seal walls with white prime seal.

3.03 INSTALLATION

A. Install Protective Wallcovering to walls in accordance with manufacturer's written instructions.

B. Allow Protective Wallcovering and adhesive to precondition for a minimum of 24 hours at a temperature between 65°F (18°C) and 85°F (29°C) before installation.

C. Install sheets with texture running in the same direction for uniform appearance.

3.04 CLEANING

A. Clean Protective Wallcovering in accordance with manufacturer's instructions.

B. Remove excess adhesive and layout marks.

END OF SECTION

SECTION 10 2601
WALL AND CORNER GUARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to this Section.

B. Section : Blocking for wall and corner guard anchors.

C. Section 09 2116 - Gypsum Board Assemblies.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

1.04 SUBMITTALS

A. See Section , for submittal procedures.

B. Product Data: Indicate .

C. Shop Drawings showing locations, extent and installation details of corner guards. Show methods of attachment to adjoining construction.

D. Samples: Submit two sections of corner guard, 12 inch (____ mm) long, illustrating component design, end cap attachment and mounting hardware, color and finish.

E. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Manufacturer's qualifications: Not less than 5 years experience in the production of specified products, and a record of successful in-service performance.

B. Installer's qualifications: Not less than 3 years experience in installation of systems similar in complexity to those required for this project.

C. Code compliance: Assemblies shall conform to all applicable codes, including IBC, UBC, SBCCI, BOCA and Life Safety.

D. Fire performance characteristics: Provide wall protection system components with UL label indicating that they are identical to those tested in accordance with ASTM E84 for Class 1 characteristecs listed below:
   1. Flame spread: 25 or less.
   2. Smoke developed: 450 or less.

E. Single source responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the project site in unopened original factory packaging clearly labeled to show manufacturer.

B. Store materials in original, undamaged packaging in a cool, dry place out of direct sunlight and exposure to the elements. A minimum room temperature of 40 deg F. and maximum of 100 deg. F should be maintained.

C. Store materials flat.

1.07 WARRANTY

A. Provide manufacturer's 1-year warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Wall and Corner Guards:
   1. Construction Specialties Inc./Acrovyn : www.c-sgroup.com.
   2. Koroseal/Korogard: www.korogard.com.
   3. IPC; InPro Corp [Basis of Design]: www.inprocorp.com.
   4. Johnsonite, Inc.: www.johnsonite.com.
   5. Nystrom, Inc: www.nystrom.com/#sle.

2.02 MATERIALS

A. Engineered PETG: Extruded material high impact Acrovyn 4000, with shadowgrain texture. Chemical and stain resistance shall be per ASTM D543 standards as established by manufacturer. Nominal 0.078" thick. Color: As selected from manufacturer's standard range.

B. Aluminum Retainer: Extruded aluminum of 6063-T6 alloy, nominal .075" thickness. Minimum strength and durability properties shall be as specified in ASTM B221.

2.03 COMPONENTS

A. Corner Guards - Surface Mounted: Acrovyn 4000; Resilient corner guards, with self adhesive tape backing.
   1. Size: 1-1/2 inches.
   2. Corner: Square.
   3. Color: As selected, unless indicated.
   4. Length: One piece, 48", unless indicated otherwise.
   5. Product: Construction Specialties Acrovyn VA-200N.
   6. /////VA-034N with 3/4" legs/////VA250N with 2-1/2" legs/////

B. Corner Guards - Surface Mounted: Engineered PETG extruded material - Acrovyn 4000, with 1/4" radius cover.
   1. Size: 3 inch legs.
   2. Height: Full height.
   3. Retainer: PVC-free regrind retainer for 90 degree angle.
   4. Color: As selected, unless indicated.
   5. Product: Construction Specialties SM-20N.

C. Corner Guards - Flush Mounted: Engineered PETG corner guards consisting of aluminum retainer with snap-on Acrovyn 4000 cover. Extruded aluminum base and closure gasket where indicated. Attachment hardware shall be appropriate for wall construction.
   1. Product: CS Acrovyn SFS-20N (or approved equal) full height 90 degree flush mounted corner guard.
      a. Size: 2 inch legs.
      b. Corner: 1/4-inch radiused.
      c. Aluminum Retainer, feathered, attach to gypsum assembly, for flush mounting. To be taped and spackled into adjacent drywall.
      d. Length: One piece, extending 3" above ceiling.
      e. Color: As selected from manufacturer's standard colors.
      f. Location: At all exposed gypsum outside corners.

2.04 ACCESSORIES

A. Fasteners: As recommended by manufacturer.

B. Adhesive: As recommended by manufacturer.

2.05 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Pre-drill holes for attachment.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to wall framing members only.

B. Corner guards shall be securely adhered to the wall and installed per the manufacturer's recommended instructions.

C. Temperatures at the time of installation must be between 65 deg F. and 75 deg F. and be maintained for at least 48 hours after installation.

3.03 TOLERANCES

A. Maximum Variation From Required Height:

B. Maximum Variation From Level or Plane For Visible Length:

3.04 CLEANING

A. Immediately upon completion of installation, clean vinyl covers and accessories in accordance with manufacturer's recommended cleaning method.

B. Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

3.05 PROTECTION

A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

END OF SECTION

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SECTION 10 2800
TOILET ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates.
   1. Public-use washroom accessories
   2. Warm-air dryers
   3. Childcare accessories
   4. Underlavatory guards
   5. Custodial accessories

1.03 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Include electrical characteristics.

B. Samples: Full size, for each exposed product and for each finish specified.
   1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.
   2. Identify products using designations indicated.

1.05 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.07 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from a single source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.08 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, visible silver spoilage defects.
   2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 OWNER-FURNISHED MATERIALS

A. Owner-Furnished Materials: TA08, TA15.

2.02 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.03 MANUFACTURER

A. Basis-of-Design Products: Subject to compliance with requirements, provide the listed Basis-of-Design Products.
   1. Bobrick Washroom Equipment, Inc. (Basis-of-Design Product Manufacturer)

2.04 SLOAN VALVE COMPANY (SOAP DISPENSERS ONLY)

A. Koala (Childcare Accessories Only)

B. Plumberex (Underlavatory Guards Only)
   1. Or comparable products by one of the following:
      a. American Specialties, Inc.
      b. Bradley Corporation.
   2. Alternate products submitted for consideration (from one of the manufacturers listed above) must show an itemized comparison with each product named below.

2.05 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue Dispenser (Standard Roll): **TA01**
   1. Basis-of-Design Product: Bobrick B-2840
      a. Description: Double-roll dispenser with utility shelf.
      b. Mounting: Surface mounted.
      c. Operation: Non-control delivery with theft-resistant spindle.
      d. Capacity: Up to 5 1/2-inch diameter tissue rolls.
      e. Material and Finish: Stainless steel, No. 4 satin finish, with high impact, black, polystyrene spindles.

B. Paper Towel Dispenser, Automatic (Roll): TA08 [OFCI]

C. Waste Receptacle, Surface Mount, Large: TA11
   1. Basis-of-Design Product: Bobrick B-277
   2. Mounting: Surface Mounted.
   3. Minimum Capacity: 12.75 gallon.
   4. Material and Finish: Stainless steel, No. 4 satin finish.
   5. Waste Receptacle Profile: Arc-front.
   6. Trash Liner Holder: Removable holding device designed to facilitate installation and removal of disposable trash liners and to retain liner inside waste receptacle. Device shall have a molded plastic sleeve with a stainless steel U-shaped support strap.

D. Soap Dispenser, Liquid Type, Manual: TA15 [OFCI]

E. Grab Bar (short): TA20
   1. Basis-of-Design Product: Bobrick B-6806 x 18
   2. Mounting: Flanges with concealed fasteners.
   3. Material and Finish:
      a. Material: Stainless steel, 0.05 inch thick.
      b. Finish: Smooth, No. 4 satin finish on ends and slip-resistant texture in grip area.
      c. Outside Diameter: 1-1/2 inches.
      d. Configuration and Length: Straight, 18 inches long.

F. Grab Bar (medium): TA21
   1. Basis-of-Design Product: Bobrick B-6806 x 36

2. Mounting: Flanges with concealed fasteners.
3. Material and Finish:
   a. Material: Stainless steel, 0.05 inch thick.
   b. Finish: Smooth, No. 4 satin finish on ends and slip-resistant texture in grip area.
   c. Outside Diameter: 1-1/2 inches.
   d. Configuration and Length: Straight, 36 inches long.

G. Grab Bar (long): TA22
1. Basis-of-Design Product: Bobrick B-6806 x 42
2. Mounting: Flanges with concealed fasteners.
3. Material and Finish:
   a. Material: Stainless steel, 0.05 inch thick.
   b. Finish: Smooth, No. 4 satin finish on ends and slip-resistant texture in grip area.
   c. Outside Diameter: 1-1/2 inches.
   d. Configuration and Length: Straight, 42 inches long.

H. Mirror, Framed, without Shelf: TA23
1. Basis-of-Design Product: Bobrick B-165-2436
2. Frame: Stainless steel channel.
3. Corners: Mitered, welded, and ground smooth.
4. Hangers: Produce rigid, tamper and theft-resistant installation, using one-piece, galvanized steel, wall hanger device with spring action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
5. Size: 24 inches wide x 36 inches high.

I. Grab Bar: TA24
1. Basis-of-Design Product: Bobrick B-6806 x 24
2. Mounting: Flanges with concealed fasteners.
3. Material and Finish:
   a. Material: Stainless steel, 0.05 inch thick.
   b. Finish: Smooth, No. 4 satin finish on ends and slip-resistant texture in grip area.
   c. Outside Diameter: 1-1/2 inches.
   d. Configuration and Length: Straight, 24 inches long.

J. Grab Bar: TA25
1. Basis-of-Design Product: Bobrick B-6806 x 12
2. Mounting: Flanges with concealed fasteners.
3. Material and Finish:Material:
   a. Stainless steel, 0.05 inch thick.
   b. Finish: Smooth, No. 4 satin finish on ends and slip-resistant texture in grip area.
   c. Outside Diameter: 1-1/2 inches.
   d. Configuration and Length: Straight, 12 inches long.

K. Robe Hook: TA26
1. Basis-of-Design Product: Bobrick B-6717
2. Mounting: Surface mounted.
3. Material and Finish: Stainless steel, No. 4 satin finish.

L. Sanitary Napkin Disposal Unit, Surface-mount: TA29
1. Basis-of-Design Product: Bobrick B-35139
2. Mounting: Surface mounted.
3. Door or Cover: Self-closing disposal opening cover and hinged face panel.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, No. 4 satin finish.

2.06 WARM AIR DRYERS

A. Warm Air Dryer: TA50

1. Basis-of-Design Product: Bobrick B-7128-115V
2. Mounting: Surface mounted.
3. Operation: Electronic sensor activated with timed power cut-off switch.
   a. Operation time: 30 to 40 seconds.
   b. Cover Material and Finish: Stainless steel, No. 4 satin finish.
   c. Electrical Requirements: 115V, 15A, 1725W.

2.07 CHILDCARE ACCESSORIES

A. Diaper-Changing Station: TA55
   1. Basis-of-Design Product: Koala KB310-SSWM
   2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
      a. Engineered to support a minimum of 250-lb static load when opened.
      b. Mounting: Surface mounted, with unit projecting not more than 4 inches from wall when closed.
      c. Operation: By pneumatic shock-absorbing mechanism.
      d. Material and Finish: Stainless steel, No. 4 satin finish.
      e. Liner Dispenser: Built in.

2.08 UNDERLAVATORY GUARDS

A. Underlavatory Guard: TA58
   1. Basis-of-Design Product: Plumberex Soft Guard Plus
   2. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
   3. Material and Finish: Antimicrobial, molded plastic, white.

2.09 CUSTODIAL ACCESSORIES

A. Mop and Broom Holder: TA60
   1. Basis-of-Design Product: Bobrick B-224 x 36
   2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
   3. Length: 36 inches.
   4. Hooks: Three.
   5. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
   6. Material and Finish: Stainless steel, No. 4 satin finish.
      a. Shelf: Not less than nominal 0.05 inch thick stainless steel.
      b. Rod: Approximately 1/4-inch-diameter stainless steel.

2.10 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.11 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of ____ keys to Owner's representative.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.02 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer’s written recommendations.

END OF SECTION 102800

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SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Knox Boxes.

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry.

B. Section 06 1000 - Rough Carpentry: Wood blocking.

C. Section 09 2116 - Gypsum Board Assemblies: Roughed-in wall openings.

1.03 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; Current Edition.

B. NFPA 10 - Standard for Portable Fire Extinguishers; 2026.

C. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, and mounting measurements for wall bracket.

C. Operation and Maintenance Data: Include test, refill, or recharge schedules and recertification requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature causes freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 FIRE EXTINGUISHERS

A. General Requirements: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated on drawings.

B. Multipurpose Dry-Chemical-Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Stored Pressure Operated: Deep drawn.
   2. Class: A:B:C.
   3. Size and classification: UL-rated 4-A: 60-B: C, 10 pound nominal capacity.
   4. Finish: Baked polyester powder coat, red color.
   5. Extent: For all locations indicated, except kitchen or food prep areas.
   6. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to 120 degrees F (49 degrees C).

C. Wet Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gauge.
   1. Class: K.
   2. Size and classification: UL-rated 10K, 5-pound nominal capacity.
   3. Finish: Polished stainless steel.
   4. Temperature Range: Minus 20 to 120 degrees F (Minus 29 to 49 degrees C).
   5. Extent: For kitchen and food prep areas.

2.02 FIRE EXTINGUISHER CABINETS

A. Metal: Formed primed steel sheet; 0.036 inch (0.9 mm) thick base metal.

B. Cabinet Configuration: Semi-recessed type, unless otherwise shown.
   1. Size to accommodate accessories.
   2. Trim: Flat rolled edge, with 2.5 inch (____ mm) wide face.

C. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with continuous piano hinge. Door style equal to Larsens "Vertical Duo".

D. Door Glazing: Acrylic plastic, clear, 1/8 inch (3 mm) thick, flat shape, and set in resilient channel glazing gasket.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with predrilled holes for placement of anchors.

F. Fabrication: Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: Baked enamel, white color.

H. Finish of Cabinet Interior: White colored enamel.

2.03 ACCESSORIES

A. Extinguisher Brackets: Formed steel, galvanized and enamel finished.

B. Cabinet Signage: Red letters: "Fire Extinguisher".

C. Knox Box: Product - Recessed, heavy duty, 10 key, Series 3200. Quantity: 1 per building. www.knoxbox.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and interfaces with other work.

B. Verify substrate and site conditions for product installation are in accordance with manufacturer's written instructions.

C. Verify rough openings for cabinet are sized and located in accordance with manufacturer's written instructions.

D. Notify Architect in writing of conditions detrimental to completion of work. Do not proceed with installation until detrimental conditions are corrected.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings; see drawings for mounting height, or, if not indicated, at height to comply with applicable regulations of governing authorities.

C. Where exact location of cabinets and bracket-mounted fire extinguishers is not indicated, locate as directed by Architect.

D. Secure rigidly in place.

E. Install one fire extinguisher in each fire extinguisher cabinet, and as indicated.

F. Recessed installation of Knox Boxes: location to be coordinated with local Fire Marshal. Install according to manufacturer's recommendations.

END OF SECTION

SECTION 10 5623
WIRE STORAGE SHELVING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wall mounted wire shelving.

B. Accessories.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 1 Specification Sections, apply to this Section.

B. Section 09 2116 - Gypsum Board Assemblies: Blocking in metal stud walls for attachment of standards.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, with installation instructions.

C. Shop Drawings: Provide drawings prepared specifically for this project; show dimensions of shelving and attachment to substrates.

D. Selection Samples: For each color selection required, submit color chips representing manufacturer's full range of available colors and finish.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

C. Store flat to prevent warpage and bending.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Wire Storage Shelving:
   1. ClosetMaid Corporation "ShelfTrack": www.closetmaid.com.
   2. Organized Living: www.organizedliving.com.
   3. RubberMaid Closet and Organization Products : www.rubbermaidcloset.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SHELVING APPLICATIONS

A. Shelf Depth: See Drawings.

B. Laundry Room: Configuration as indicated. Close-mesh cross wire spacing (1/2").

2.03 MATERIALS

A. Wire Shelving: Factory-assembled coated wire mesh shelf assemblies for wall-mounting, with all components and connections required to produce a rigid structure that is free of buckling and warping.
   1. Construction: Cold-drawn steel wire with average tensile strength of 100,000 psi resistance welded into uniform mesh units, square, rigid, flat, and free of dents or other distortions, with wires trimmed smooth.
   2. Coating: PVC or epoxy, applied after fabrication, covering all surfaces.
   3. PVC Coating: 9 to 11 mils thick.

4. Epoxy Coating: Non-toxic epoxy-polyester powder coating baked-on finish, 3 to 5 mils thick.
5. Shelf and Rod Units: Integral hanging rod at front edge of shelf.

B. Wall-Mounted Standards: Vertically slotted channel standards with double-tab cantilever brackets to suit shelving; factory finished to match shelving.

C. Fasteners: As recommended by manufacturer for mounting substrates.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect areas to receive shelving, to verify that spaces are properly prepared to receive shelf units, and are of dimensions indicated on shop drawings.

B. Verify appropriate fastening hardware.

C. Do not begin installation until substrates have been properly prepared.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, with shelf surfaces level.

B. Cap exposed ends of cut wires.

C. Install back clips, end clips at side walls, and support braces at open ends. Install intermediate support braces as recommended by manufacturer.

D. Mounting Heights:
1. See drawings.

3.04 CLEANING

A. Clean soiled surfaces after installation.

3.05 PROTECTION

A. Protect installed work from damage.

B. Touch-up, repair, or replace damaged products before Substantial Completion in a manner that eliminates evidence of replacement.

END OF SECTION

SECTION 10 7316
CANOPIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work in this section includes furnishing and installation of extruded aluminum canopy.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 03 3100 - Concrete.

C. Section 04 2000 - Unit Masonry.

D. Section 05 5000 - Metal Fabrications.

E. Section 07 6200 - Sheet Metal Flashing and Trim.

F. Section 07 9005 - Joint Sealers.

1.03 REFERENCE STANDARDS

A. Aluminum Design Manual 2000, Specifications & Guidelines for Aluminum Structures.

B. ASCE 7, Minimum Design Loads for Buildings and Other Structures.

C. American Architectural Manufacturer's Association (AAMA).

D. American Society for Testing and Materials (ASTM).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's product information, specifications and installation instructions for building components and accessories.

C. Shop Drawings: Indicate all necessary plan dimensions, elevations and details. General Contractor shall verify all dimensions and provide elevations at each column, finish floor, and related soffit before releasing to manufacturer for fabrication.

D. Certification: Submit design calculations signed by a Registered Professional Engineer, licensed in Alabama. Design calculations shall state that the canopy system complies with the wind requirements of ASCE 7-95, the applicable building code, and all other governing criteria.

E. Warranty: Submit manufacturer's warranty (as described below) and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience, and approved by manufacturer.

D. Wind Uplift: Provide roof and vertical panel systems including supports meeting requirements of Underwriters Laboratories, Inc. for Class 90 wind uplift resistance.
   1. Minimum Code Wind Load at Site: 90 mph (IBC 2006).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store all canopy components in protected areas.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Canopy system, including materials and workmanship, shall be warranted from defects for a period of one year from substantial completion of installation.

C. Provide 10 year manufacturer warranty for canopy system remaining intact (without perceptible deformation) and completely leak-free for 10-years from date of acceptance of project (this warranty need not cover damage from winds exceeding the velocities and/or loading required by the International Building Code.

D. Provide 20 year manufacturer warranty covering finish of canopy when finished with fluoropolymer coating.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Architectural Shade Products; [Basis of Design]: www.architecturalshade.com.

B. Mapes Canopies: www.mapes.com.

C. Mason Corporation: www.masoncorp.com.

D. Mitchell Metals: www.mitchellmetals.net.

E. Peachtree Protective Covers: www.peachtreecovers.com.

F. Tennessee Valley Metals, Inc.,: www.tvmetals.com.

G. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Structural Components (including but not limited to decking, beams, posts, fascia, channels, tubes, angles, mounting plates and hanger rods) shall be extruded aluminum, alloy 6063-T6.

B. Fasteners: aluminum, 18-8 stainless steel or 300 series stainless steel.

2.03 COMPONENTS

A. Columns: Columns shall be radius-cornered tubular extrusion of size indicated, with cutout and internal diverter for drainage where required.

B. Beams: Beams shall be open-top tubular extrusion of size and shape indicated, top edges thickened for strength and designed to receive deck members in self-flashing manner. Provide structural ties in tops of all beams.

C. Channels, Tubes, Angles, Hanger Rods, and Mounting Plates: Structural aluminum extrusions

D. Deck: Deck shall be extruded self-flashing sections interlocking into a composite unit.

E. Fascia: Fascia shall be size and shape as indicated.

F. Flashing: Flashing shall be .040" aluminum (min.).

2.04 FABRICATION

A. Columns and gutter beams shall be designed such that the columns will be notched to receive and secure the gutter beams.

B. Support channels and beams shall be designed to receive and secure the gutter beams.

C. Beams shall be positively connected with neatly mitered corners.

D. Deck shall be manufactured of extruded modules that interlock in a self-flashing manner. Assemble deck with sufficient camber to offset dead load deflection.

E. Concealed drainage: Water shall drain from covered surfaces into integral gutter beam and be directed to ground level discharge via one or more designated support posts.

2.05 FACTORY FINISHING

A. Fluoropolymer (Kynar) finish: AAMA 2605, three coat.

B. Color: Selected from manufacturer's standard colors.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrates are ready to receive work.

3.02 PREPARATION

A. Erection shall be performed after all concrete, masonry, and roofing work in the vicinity is complete and cleaned.

3.03 INSTALLATION

A. Installation shall be in strict accordance with manufacturer's recommendations and approved shop drawings.

B. Blockouts, if required, shall be provided by manufacturer, and installed by General Contractor.

C. Erect beams true to line, level and plumb.

D. Aluminum columns embedded in concrete shall be protected by acrylic.

E. Downspout columns shall be filled with grout to the discharge level to prevent standing water.

F. Non-draining columns shall have weep holes installed at top of concrete to remove condensation.

3.04 CLEANING

A. After installation, entire system shall be left in a clean condition.

3.05 PROTECTION

A. Protect the finish during handling and erection.

B. Take all precautions needed to protect entire canopy system from damage during subsequent construction activity until time of Substantial Completion.

END OF SECTION

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SECTION 11 3100
KITCHEN AND LAUNDRY EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Kitchen appliances.

B. Laundry appliances.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Division 22 Section for Plumbing Piping: Plumbing connections for appliances.

C. Division 26 Section for Equipment Wiring: Electrical connections for appliances.

1.03 REFERENCE STANDARDS

A. UL (EAUED) - Electrical Appliance and Utilization Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.

C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Electric Appliances: Listed and labeled by UL and complying with NEMA standards.

C. Gas Appliances: Bearing design certification seal of AGA.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.

PART 2 - PRODUCTS

2.01 KITCHEN APPLIANCES

A. All Equipment Eligible for Energy Star Rating: Energy Star Rated.

B. Refrigerator : Free-standing, side-by-side, frost-free.
   1. Capacity: Total storage of 21.7 cubic ft (____ cu m)____.
   2. Features: Include glass shelves.
   3. Finish: Stainless steel.
   4. Slideout Spillproof Shelves: 3 minimum.
   5. Width: 32-3/4 inches, maximum.
   6. Depth: 33-5/8 inches.
   7. Height: 66-5/8 inches.
   8. Location: See drawings.
   9. Manufacturer/Product: Whirlpool WRS312SNH.
   10. Other Manufacturers:
      a. GE Appliances: www.geappliances.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

C. Microwave, Commercial: Countertop: Capacity: 0.8 cu.ft.; Power Rating: 1000 watts; Exterior Dimensions: 20-1/8"W x 16-1/2"D x 12"H; 6 minute dial timer.
   1. Door Finish: Stainless steel.
   2. Power Source: 120V, 60Hz, Single Phase.
   3. Finish and color: Satin Stainless Steel.
   4. Location: See Drawings.
   5. Manufacturers:
      a. GE: www.geappliances.com.
      b. Kenmore Appliances: www.kenmore.com.
      c. Panasonic Commercial Microwave Oven Model NE-1025F [Basis of Design]: www.panasonic.com.
      d. Whirlpool Corp.

D. Ice Machine: Nugget Ice Maker and Storage Bin:
   1. Stainless Steel exterior.
   2. Provide with water filter and other required accessories.
   3. Warranty: Minimum 3 year parts and labor on all components. 5 year parts on compressor.
   4. Size: 22"W x 23.63"D x 26"H ice maker. 22"W x 34"D x 44"H storage bin, on 6" legs
   5. Location: See drawings.
   6. Manufacturer/Product: Basis of Design: Manitowocice "RNP0320A" Nugget Ice Machine & "D-240" Storage Bin: www.manitowocice.com
   7. Other Manufacturers:
      a. Ice-O-Matic: www.iceomatic.com.
      b. Scotsman: www.scotsman-ice.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LAUNDRY APPLIANCES

A. Clothes Washer : Front-loading.
   1. Capacity: Approximately 4.5 cu. ft.
   2. ADA Compliant.
   3. Energy Star Compliant.
   4. Controls: - Electronic with LED's.
   5. Cycles: Include normal.
   6. Finish: Painted steel, color white.
   7. Size: Must match dryer. Approximately 39-3/4"H x 28"W x 32"D.
   8. Location: See drawings.
   9. Product: GE Appliance Model# GFW550SSNWW: www.geappliances.com.
   10. Other Manufacturers:
      a. Frigidaire Home Products; Product ____: www.frigidaire.com.
      b. Kenmore: www.kenmore.com.
      c. Whirlpool Corp; Product ____: www.whirlpool.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. Clothes Dryer Type ____: Electric, stationary.
   1. Capacity: Approximately 7.4 cu. ft.
   2. ADA Compliant.
   3. Controls: Electronic with LED's - , with timer dry control.
   4. Temperature Selections: five.
   5. Features: Include interior light and end of cycle signal.
   6. Finish: Painted steel, color white.
   7. Drum: Aluminized Steel.
   8. Size: Must match washer. Approximately 39-3/4"H x 28"W x 32"D.
   9. Location: See drawings.
   10. Product: GE Appliance Model# GFD55ESSNWW: www.geappliances.com.

11. Other Manufacturers:
    a. Frigidaire Home Products; Product ____: www.frigidaire.com.
    b. Kenmore: www.kenmore.com.
    c. Whirlpool Corp; Product ____: www.whirlpool.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify utility rough-ins are present and correctly located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Anchor built-in equipment in place.

3.03 ADJUSTING

A. Adjust operating equipment to efficient operation.

3.04 CLEANING

A. Remove packing materials from equipment.

B. Wash and clean equipment.

END OF SECTION

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SECTION 12 2114
HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. 2" Horizontal faux wood slat louver blinds.

B. Horizontal louver blinds with aluminum slats.

C. Operating hardware.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating physical and dimensional characteristics and operating features.

C. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.

D. Samples: Submit two samples, 6 inch (____ mm) long illustrating slat materials and finish, color, cord type and color.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Blind Assemblies: Two of each size.
   3. Extra Slats: 20 of each type and size.
   4. Extra Lift Cords, Control Cords, and Wands: One of each type.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver product in manufacturer's original packaging.

B. Handle and store product to prevent damage to materials, finishes, and operating mechanisms. Store in a clean, dry area, laid flat to prevent sagging and twisting of packaging.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Horizontal Louver Blinds:
   1. Hunter Douglas: www.hunterdouglas.com.
   2. Levolor Contract: www.levolorcontract.com.
   3. Graber, division of Springs Window Fashions: www.graberblinds.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 BLINDS AND BLIND COMPONENTS

A. Blinds: Horizontal slat louvers hung from full-width headrail with full-width bottom rail; manual control of raising and lowering by cord with full range locking; blade angle adjustable by control wand; complying with WCMA A100.1.
   1. Extent: See drawings.

B. Wood Slats: _____ square or square slat corners, as selected. Resistant to warping.
   1. Width: 2 inch (50 mm).
   2. Thickness: 1/8 inch (____ mm).
   3. Pre-finished to color as selected.

C. Slat Support: Braided 100% polyester yarn, ladder configuration.

D. Head Rail: Pre-finished, formed steel box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.
   1. Dimensions: 2" H x 2-1/4" W x 0.022" thick U-shaped steel.
   2. Finish: Finish steel with phosphate treatment for corrosion resistance, chrome-free sealer, low HAP urethane primer, and topcoat of low HAP polyester baked enamel.
   3. Color: As selected.

E. Bottom Rail: Pre-finished, 9/16" high x 2" wide PVC in rectangular shape to improve closure. Color: As selected.
   1. Finish: Coordinate with slats.

F. Lift Cord: Braided polyester; continuous loop.
   1. Free end weighted.
   2. Color: As selected.

G. Control Wand: Extruded solid plastic; hexagonal shape.
   1. Color: clear.

H. Cord Tilter: Snap-in component incorporating a worm and pulley of low-friction thermoplastic and a nylon gear. Tilt cords shall be secured to pulley and treated with wood tassels at tilt end. Standard cord tilter.

I. Cord Lock: Metal of a snap-in design incorporating a floating shaft type locking pin and shall incorporate a crash proof safety feature that will lock blind automatically upon release of cord. End of lift cords will be treated with wood tassels.

J. Headrail Attachment: Wall brackets.

K. Accessory Hardware: Type recommended by blind manufacturer.

2.03 FABRICATION

A. Determine sizes by field measurement.

B. Fabricate blinds to fit within openings with uniform edge clearance of 1/8 inch (____ mm).

C. At openings requiring multiple blind units, provide separate blind assemblies with space of 1/8 inch (____ mm) between blinds, located at window mullion centers.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that openings are ready to receive the work.

B. Ensure structural blocking and supports are correctly placed.

3.02 INSTALLATION

A. Install blinds in accordance with manufacturer's instructions.

B. Install blinds with adequate clearance to permit smooth operation of the blinds.

C. Secure in place with flush countersunk fasteners.

3.03 INSTALLATION TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch (6 mm).

B. Maximum Offset From Level: 1/8 inch (3 mm).

3.04 ADJUSTING

A. Adjust blinds for smooth operation.

3.05 CLEANING

A. Clean blind surfaces just prior to occupancy.

END OF SECTION

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SECTION 12 3219
LAMINATE CASEWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division 1 - Specification sections, apply to work of this section.

1.02 WORK INCLUDED

A. The extent of manufactured casework systems as shown on drawings, schedules, and specified herein. Where specific materials, finishes, construction details, and hardware are specified herein, the casework contractor shall be held in strict accordance. All items shall be as provided, and publicly cataloged, by the manufacturers to assure physical and dimensional integrity of the system and ready access to additional systems components for a minimum of ten (10) years after completion of this contract. Product from companies not meeting this requirement will not be accepted. It is the intent of the owner and architect and construction manager to have this specification section furnished by one contractor.

B. Furnish and install all fixed, modular, and mobile laminate clad casework, tops and accessories and components, fillers and related items shown on drawings and herein specified. All built-in and modular plastic laminate counter tops and splashes are specified herein and detailed on architectural.

C. Furnish and install all locks for cabinet doors and drawers as indicated on elevations of the architectural drawings.

D. In areas where architectural woodwork, "millwork", and casework are combined or adjacent to one another, millwork and casework are to be fully coordinated and supplied from a single source.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Sinks and service fixtures, service and waste lines and all connections, vents, electrical service fixtures, hoods and ducting within or adjacent to casework, or otherwise required in all areas except Science labs and Science classrooms: Furnished and installed under Mechanical and Electrical Divisions 22-23, and 26.

B. Base molding: Furnished and installed under Finishes Division 9, to be consistent with base molding in room, unless base is not specified, in which case laminate base shall be applied.

C. Appliances, unless specifically noted on plans as included in this section.

D. Furnishing, installing and connecting of service supply lines and conduits within equipment and reagent racks, connecting of exposed service lines, connecting of services in tunnels or service turrets through, under, or along backs of working surfaces as required for utility service fixtures.

E. Installing all utility service outlet accessory fittings and fixtures furnished by casework contractor, pulling of wire and connecting of electrical fixtures in service lines, provision of ground fault protection for circuits requiring such.

F. Receiving, installing and connecting all separate sinks, cup sinks or drains, draining troughs, overflows and sink outlets, as furnished by the casework contractor for the Work Room and Storage Room areas.

G. Furnishing, installing and connecting all traps, tailpieces, backflow prevention devices and special plumbing fittings and piping of unusual nature to meet local codes even though not specifically called for in specifications or shown on drawings.

H. Furnishing and installing of all framing, bucks, metal grounds or reinforcements in walls, floors, ceilings to adequately support and anchor casework and related equipment.

I. Furnishing fluorescent tubes, light bulbs and any miscellaneous materials generally classified as maintenance or supply items.

J. General Contractor or Owner shall furnish hoisting or elevator service, where available, at no charge to casework contractor.

K. Coordination with millwork items as specified in Section 06 4000 - "Architectural Woodwork".

1.04 SYSTEM DESCRIPTION

A. All manufactured casework shall be pre-engineered, and cataloged in a nationally published catalog. Manufacturers submitting for approval must provide printed catalog information documenting this performance feature; no exceptions will be allowed.

1.05 QUALITY ASSURANCE

A. All manufactured casework systems, countertops and related items herein specified shall be furnished be one contractor to insure single source responsibility, and integration with other building trades

B. All manufacturers herein listed, shall show evidence of a minimum of five (5) years experience in providing manufactured casework systems for similar types of projects.

C. Manufacturer shall produce evidence of adequate facilities and personnel required to perform on this project. Financial stability of manufacturer shall be evidenced by readily providing a material performance bond if required.

D. Manufactured casework systems must conform to design, quality of materials, workmanship and function as shown on drawings and specified herein. In the absence of a printed specification, minimum quality standards shall be in accordance with AWI Section 1600B, Sixth Edition, Version 1.1, no exceptions will be permitted; additional requirements shall be as specified herein.

E. Provide independent laboratory testing documenting that the support rail and interfacing components when tested in strict accordance with the requirements of seismic construction codes, all components met or exceeded the requirements as set forth by the codes. All casework bidders must provide a copy of test to architect ten days prior to bid date.

F. All casework bidders must provide the following test results as tested by an independent testing firm:
   1. Racking Test (must exceed 975 lbs.)
   2. Front Joint Load Test (must exceed 635lbs.)
   3. Uniform Load Shelf Test (must exceed 1140 lbs.)
   4. Isolated Shelf Clip Load Test (must exceed 640 lbs.)
   5. Static Load Test (must exceed 1800 lbs with no cabinet failure)
   6. Draw Side Joint Test (must exceed 425 lbs.)
   7. Draw Front Joint Test (must exceed 925lbs.)
   8. Draw Static Load Test (must exceed 900 lbs.)

G. The architect and owner reserves the right to randomly select one 36” wide base cabinet and one 36” wide wall cabinet and one 36” wide tall cabinet from each manufacturer during installation and cut apart to determine if the product installed meets the written specification. The casework manufacturer shall include the price to replace these units in his bid. If the product fails to meet the specification then the casework supplier shall be responsible to make any and all necessary corrections.

1.06 SUBMITTALS

A. Product Data:
   1. In addition to the general conditions as relates to prior approvals, submittals of manufacturer's data, installation instructions, and samples are required upon architect's request.

B. Samples:
   1. Submit samples of casework manufacturer's standard decorative laminate colors, patterns, and textures for exposed and semi-exposed materials for architect's selection. Samples of other materials or hardware shall be made available if requested.

2. Architect may request representative full-size samples for evaluation prior to approval. Samples may be impounded by architect/owner until completion of project to ensure compliance with specifications.
3. Submit copy of Seismic testing report.

C. Production Drawings:
1. Submit production drawings for all casework systems and countertops and required equipment, ends, cross-sections, face modular values, service run spaces and location of services.
2. Include layout of units with relation to surrounding walls, doors, windows, and other building components.
3. Coordinate production drawings with other work involved.

1.07 PRODUCT HANDLING

A. Deliver casework and countertops only after wet operations in building are completed.

B. Store completed casework and countertops in a ventilated place, protected from the weather, with relative humidity range of 20% to 50%.

C. Protect finished surfaces from soiling and damage during handling and installation.

D. General Contractor shall be responsible for protection of all casework and tops after installation is completed.

1.08 JOB CONDITIONS

A. Humidity and Temperature Controls:
1. Before the delivery and installation of casework and equipment, building conditions shall be as follows:
a. The building shall be secure and weather tight, with windows and doors installed, heat and air conditioning systems functional.
b. Walls and openings shall be plumb, straight and square. Concrete floors shall be level within acceptable trade tolerances. Specifically the floor must be within 1/8" of level per 10 foot run, non-accumulative, when tested with a straight edge in any one direction.
c. Flooring required to be placed under casework and equipment must be installed.
d. Wood or metal blocking (wall grounds) shall be installed within partitions prior to delivery of casework and furnishings to allow for immediate installation on delivery.
e. General Contractor shall have heat and air conditioning systems providing consistent temperature and humidity conditions as required Related humidity must be maintained at not less than 25%, nor more than 55%. Temperatures must not range lower than 65 degrees F, not to exceed 80 degrees F in areas of material installation.
f. All overhead mechanical, electrical or plumbing rough-in work shall be complete
g. Any “wet” operation performed by other trades must be complete prior to delivery.
h. Ceiling grids (with or without ceiling tiles), overhead soffits, duct work and lighting shall be installed.
i. Painting shall be complete.
j. General Contractor shall provide a secure storage area within the building that is clean, dry well ventilated, protected from direct sunlight and broom clean.

1.09 WARRANTY

A. The manufacturer shall guarantee all materials and workmanship of equipment provided in this contract for a period of five years from date of final acceptance. This is a warranty of replacement and repair only, whereby the manufacturer will correct defects in materials and/or workmanship without charge. Any defective materials of faulty workmanship occurring within that time shall be replaced or corrected promptly without charge upon notification by the owner or his designated representative. All bidders are to provide to the Architect a copy of the manufacturers warranty for the casework ten (10) days before the bid date.

PART 2 – PRODUCTS

2.01 PLASTIC LAMINATE CASEWORK

A. Manufacturers: Subject to compliance with specifications, provide products by one of the following:
   1. Casework Systems:
      a. TMI Systems Design Corporation.
      b. Case Systems, Inc.
      c. LSI Corporation of America, Inc.
      d. Stevens Industries, Inc.
      e. Jastev Casework.
      f. JIMCO, Inc.
   2. Plastic Laminate: Subject to compliance with requirements, provide solid, stippled, textured, and/or patterned high pressure decorative laminates of one of the following:
      a. Formica Corporation.
      b. Micarta Division, Westinghouse Electric Corporation.
      c. Nevamar Division, International Paper Co.
      d. Ralph Wilson Plastics Co.

B. Substitutions:
   1. It is the intent of this specification to establish performance and quality criteria consistent with pre-established standards of design and function herein described. Casework systems not meeting these minimum standards will not be accepted.
   2. Where specific materials, finish options, construction details, modularity, hardware and test data are specified herein, the casework storage system will be held in strict compliance. Substitutions will be considered prior to bid date provided request is submitted to the architect, in writing, no later than ten (10) days prior to bid date; substitution request shall list any and all deviations from this specification. Requests later than ten (10) days prior to bid will not be considered. Acceptable substitutions will be identified in future addenda.
   3. All manufacturers must submit the following items to the architect ten days prior to bid date to be qualified to bid.
      a. A Copy of required Seismic Testing Data related to rail casework.
      b. ADA Brochure depicting ADA requirements and compliance
      c. All required independent test reports.
      d. A sample of a rail mounted base cabinet and rail chase system demonstrating rail and interfacing system and hardware.
      e. A sample base cabinet of fixed base cabinet with required hardware.
      f. A copy of Guarantee and Limited Warranty.
      g. A detailed deviation list addressing where the requested product deviates from the specified product.

2.02 MATERIALS

A. Core Materials:
   1. MR Moisture Resistant Medium Density Fiberboard: Average 47-pound density grade, ANSI A 208.2.
   2. Medium Density Fiberboard: Average 47-pound density grade, ANSI A 208.2.
   3. Grade AB Plywood

B. Hardboard: 1/4 inch thick prefinished hardboard, CS-251.

C. Decorative Laminates:
   1. High-pressure decorative laminate VGS (.028), NEMA Test LD 3-1995. for vertical surfaces.
   2. High-pressure decorative laminate HGS (.048), NEMA Test LD 3-1995 for horizontal Surfaces.

3. High-pressure decorative laminate HGP (.039), NEMA Test LD 3-1995 for post formed tops.
4. High-pressure cabinet liner CLS (.020), NEMA Test LD 3-1995.
5. High-pressure backer BKH (.048), (.039), (.028), NEMA Test LD3-1995.
6. Thermally fused melamine laminate, NEMA Test LD 3-1995.

D. Laminate Color Selection: Maximum 1 color per unit face and 5 colors per project. (See Color Selection in section 3.05).

E. Edging Materials:
1. 1 mm PVC banding.
2. 3mm PVC banding, machine profiled to 1/8 inch radius, where required and herein specified..

F. Grommets:
1. 2-1/2" x 6" black, plastic oval grommet. See Drawings for location.

G. Glass:
1. Wall unit full sliding glass doors: 1/4 inch laminated safety glass.
2. Glass insert doors, hinged or sliding wall cabinets: 1/4 inch laminated safety glass.
3. Glass insert doors, hinged or sliding tall or base cabinets. 1/4 inch laminate safety glass.
4. Sliding doors mounted in aluminum track.
5. Trim glass inserts: Extruded rigid PVC.

2.03 SPECIALTY ITEMS

A. Metal Parts:
1. Countertop support brackets, undercounter support frames, legs and miscellaneous metal parts shall be furniture steel, welded, degreased, cleaned, treated and epoxy powder painted. Color shall be as selected by Architect from manufacturer's standard colors.

2.04 CABINET HARDWARE

A. Hinges:
1. 170-degree adjustable "CLIP System" concealed self-closing hinges as manufactured by Julius Blum, Inc., or equivalent by Grass or Stanley.
a. Doors 48 inch and over in height shall have 3 hinges per door.

B. Pulls:
1. Wire pulls equivalent to Stanley No. 4484, aluminum satin (ANSI B12012), 4-inches long, with 1-inch clearance; finish to match Section 08 7100 - "Finish Hardware" finish in room(s) where occurs. Pull design shall comply with the Americans with Disability Act (ADA).

C. Drawer Slides:
1. Regular, knee space and pencil slides shall be 100-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers and have a positive stop both directions with self-closing feature. Paper storage units shall have 150-pound load rated epoxy coated steel slides.
2. File: Full extension, Shall have 150-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers and have positive stop both directions with self-closing feature.

D. Adjustable Shelf Supports:
1. Injection molded transparent polycarbonate friction shall fit into cabinet end panels and vertical dividers, adjustable on 32mm centers. Each shelf support shall have 2 integral support pins, 5mm diameter, to interface pre-drilled holes, and to prevent accidental rotation of support. The support shall automatically adapt to 3/4 inch or 1 inch thick shelving and provide a non-tip feature for shelving. Supports may be field fixed if desired. Structural load to 1200 pounds (300 pounds per support) without failure.

E. Locks:

1. Shall be National #M49054, removable core, disc tumbler, cam style lock with strike. Furnish 2 keys. Lock for sliding 3/4 inch doors shall be a disc type plunger lock, sliding door type with strike. Lock for sliding glass / acrylic doors shall be a ratchet type sliding showcase lock.
2. Automatic door bolt shall be Hafele #530-1604, used to secure inactive door on all locked cabinets.

F. Coat Rods: Shall be 1 inch diameter, 14-gauge chrome plated steel installed in captive mounting hardware.

G. File Suspension System: Shall be14-gauge steel file suspension rails, epoxy powder coated. File followers, or other split bottom hardware, will not be acceptable.

2.05 FABRICATION

A. Fabricate casework, countertops and related products to dimensions, profiles, and details shown.

B. Cabinet Body Construction:
1. Tops and bottoms are glued and doweled to cabinet sides and internal cabinet components such as fixed horizontals, rails and verticals.
2. Minimum 6 dowels each joint for 24 inch deep cabinets and a minimum of 4 dowels each joint for 12 inch deep cabinets.
3. Tops, bottoms and sides of all cabinets are 3/4 inch thick particleboard core.
4. Cabinet backs: 1/2 inch thick. Wall and tall cabinets are provided with a 1-inch x 1-3/4 inch PVC mounting strip used to secure the cabinet to the wall.
   a. Exposed back on fixed or movable cabinets: 3/4 inch particleboard with the exterior surface finished in VGS laminate as selected.
   b. Flexible rail mounted cabinet backs: 3/4 inch thick particleboard structurally doweled into cabinet sides and top panels.
5. Fixed base and tall units have an individual factory-applied base, constructed of 3/4 inch exterior grade plywood. Base is 96mm (nominal 4 inch) high unless otherwise indicated on the drawing.
6. Base units, except sink base units: Full sub-top. Sink base units are provided with open top, a welded steel/epoxy painted sink rail full width at top front edge concealed behind face rail/doors, a split back removable access panel.
7. Side panels and vertical dividers shall receive adjustable shelf hardware at 32mm line boring centers. Mount door hinges, drawer slides and pull-out shelves in the line boring for consistent alignment.
8. Exposed and semi exposed edges.
   a. Edging: 1mm PVC
9. Adjustable shelf core: 1 inch thick particleboard up to 36 inches wide, 1-inch thick particleboard with corrugated metal ribbed stiffener for shelves over 36 inches wide.
   a. Front edge: 1mm PVC.
10. Interior finish, units with open Interiors:
   a. Top, bottom, sides, horizontal and vertical members, and adjustable shelving faces with VGS High Pressure decorative laminate.
11. Interior finish, units with closed Interiors:
   a. Top, bottom, sides, horizontal and vertical members, and adjustable shelving faces with thermally fused melamine laminate with matching prefinished back.
12. Exposed ends:
   a. Faced with VGS high-pressure decorative laminate.
13. Wall unit bottom
   a. Faced with thermally fused melamine laminate.
14. Wall and tall unit tops:
   a. Top surface is faced with thermally fused melamine laminate.
15. Balanced construction of all laminated panels is mandatory.

16. Unfinished core stock surfaces, even on concealed surfaces (excluding edges), not permitted.
17. Provide oval grommets 3'-0" o.c. in bracket supported countertops.

C. Drawers:
1. Sides, back and sub front: Minimum 1/2 inch thick particleboard, laminated with thermally fused melamine doweled and glued into sides. Top edge banded with 1mm PVC.
2. Drawer bottom: Minimum 1/2 inch thick particleboard laminated with thermally fused melamine, screwed directly to the bottom edges of drawer box.
3. Paper storage drawers: Minimum 3/4 inch thick particleboard sides, back, and sub front laminated with thermally fused melamine. Minimum 1/2 inch thick particleboard drawer bottoms screwed directly to the bottom edges of the drawer box. Provide PVC angle retaining bar at the rear of the drawer.

D. Door/Drawer Fronts:
1. Core: 3/4 inch thick particleboard.
2. Provide double doors in opening in excess of 24 inches wide.
3. Faces:
   a. Exterior: VGS High-pressure decorative laminate.
   b. Interior: High-pressure cabinet liner CLS.
4. Door/drawer edges: 3mm PVC, external edges and outside corners machine profiled to 1/8 inch radius.
5. Miscellaneous Shelving:
   a. Core material: 3/4 inch or 1 inch particleboard.
   b. Exterior: VGS High-pressure decorative laminate.
   c. Edges: 3mm PVC, external edges and outside corners machine profiled to 1/8 inch radius.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions under provisions of Section 01 7000.

B. Verify that openings are ready to receive work.

C. Verify adequacy of support framing anchors.

D. Verify that required utilities are available. In proper locations and ready for use.

E. Beginning of installation means installer accepts existing surface conditions.

3.02 INSTALLATION

A. Install casework, components and accessories in accordance with manufacturer's instructions.

B. Use anchoring devices to suit condition and substrate materials encountered.

C. Set casework items plumb and square.

D. Install casework attachment rails on wall along entire length of wall to facilitate installation of wall cabinets.

E. Hang wall mounted casework on attachment rails. Level and adjust wall casework using adjustment capabilities of wall unit mounting brackets.

F. Assemble and install worksurface tops on site with use of concealed screws on bases such as base cabinets, pedestals or columns

G. Scribe to abutting surfaces and align adjoining components. Apply matching filler pieces where casework abuts dissimilar construction.

H. Repair small scratches and surface blemishes on units using manufacturer's supplied touch up materials or replace units as required.

3.03 ADJUSTING

A. Adjust work under provisions of Section 01 7000.

B. Adjust doors, drawers, hardware, fixtures, and other moving or operating parts to function smoothly.

3.04 CLEANING

A. Clean work under provisions of Section 01 7000.

B. Clean casework, counters, shelves, glass, legs, hardware, fittings, and fixtures

C. Remove dirt with damp cloth and soap and water. Remove stubborn dirt with non-flammable chlorinated solvents or solvents such as: lacquer thinner, M.E.K., or contact adhesive solvent if area is ventilated sufficiently to prevent build-up of fumes and noticeable odors. Do not use harsh abrasive cleaners.

3.05 PROTECTION OF FINISHED WORK

A. Protect finished work under provisions of Section 01 7000.

B. Do not permit finished casework to be exposed to continued construction activity.

C. Protect finished casework from damage by water, heat and other causes until final acceptance.

D. Replace casework exhibiting warpage, surface discoloration, and damage at no additional cost to owner.

END OF SECTION

SECTION 12 4813
ENTRANCE FLOOR MATS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet mat.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating properties of walk-off surface, component dimensions and recessed frame characteristics.

C. Shop Drawings: Indicate dimensions and details for recessed frame.

D. Samples: Submit two samples, ___ by ___ inches (___ by ___ mm) in size illustrating pattern, color, finish, and edging.

PART 2 PRODUCTS

2.01 FLOOR MATS

A. Carpet Mat: Cut nylon pile permanently bonded to vinyl backing; 24 inch (609.6 mm) wide by 24 inches (609.6 mm) long.
   1. Colors: As indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor opening for mats are ready to receive work.

3.02 INSTALLATION

A. Install walk-off surface in floor recess flush with finish floor after cleaning of finish flooring.

END OF SECTION

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SECTION 21 0451

GENERAL FIRE PROTECTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all labor, materials, equipment, and services necessary for the design, fabrication, installation, testing, and commissioning of fire protection systems as indicated on the Contract Documents and specified herein, including but not limited to:
   1. Automatic sprinkler systems.
   2. Fire department connections (FDC) and Siamese inlets.
   3. Special hazard suppression systems.
   4. Firestopping of all penetrations in rated walls, floors, and ceilings.

B. Related Systems Coordination:
   1. Fire alarm and detection devices for supervisory and flow-switch integration.
   2. HVAC, plumbing, and electrical penetrations for sleeves, insulation, and power wiring.

C. Compliance Requirements:
   1. Install and test all systems in strict accordance with the applicable editions of the NFPA, IBC/IFC, and local amendments.
   2. Where local codes are more stringent, the local requirements shall govern.

D. Exclusions:
   1. Work specifically indicated to be furnished under Division 1 “Alternate” scopes or by other trades.

E. Closeout:
   1. Provide as-built drawings, O&M manuals, test certificates, and third-party inspection reports.

1.2 DEFINITIONS

A. AHJ (Authority Having Jurisdiction): The organization, office, or individual responsible for approving equipment, materials, and procedures and enforcing the code (e.g., Fire Marshal).

B. Automatic Sprinkler System: A network of piping and sprinkler heads that discharges water automatically when a heat-sensing element actuates.

C. Wet-Pipe System: A sprinkler system in which the supply piping is maintained full of water at all times.

D. Fire Department Connection (FDC): A paired inlet (or Siamese) allowing the fire service to pump supplemental water into the sprinkler or standpipe system.

E. Firestop: Materials and assemblies used to restore the fire-rating of walls, floors, and ceilings penetrated by piping or ducts.

F. NFPA: National Fire Protection Association. All NFPA documents referenced are the editions indicated in Section 1.6.

G. IBC: International Building Code.

H. IFC: International Fire Code.

1.3 APPLICABLE CODES AND STANDARDS

A. International Codes
   1. IBC – International Building Code, 2021 Edition.

2. IFC – International Fire Code, 2021 Edition.
3. NFPA 101 – Life Safety Code, 2021 Edition.

B. Sprinkler, Standpipe & Pump Standards
1. NFPA 13 – Installation of Sprinkler Systems, 2021 Edition.
2. NFPA 25 – Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2020 Edition.

C. Fire Alarm & Detection
1. NFPA 72 – National Fire Alarm and Signaling Code.
2. UL 864 – Control Units and Accessories for Fire Alarm Systems, Latest Edition.
3. UL 268 – Smoke Detectors for Fire Alarm Systems, Latest Edition.

D. Firestop & Material Tests
1. UL 1479 / ASTM E814 – Fire Tests of Through-Penetration Fire Stops, Latest Edition.
2. ASTM E84 – Surface Burning Characteristics of Building Materials, Latest Edition.
3. ASTM E119 – Fire Tests of Building Construction and Materials, Latest Edition.

E. Auxiliary Standards
1. NFPA 70 – National Electrical Code, (for fire-pump power and alarm wiring).
2. NFPA 291 – Flow Testing of Fire Protection Systems, Latest Edition.
3. NFPA 101A – Guide on Alternative Approaches to Life Safety, Latest Edition.

F. Division References
1. Division 01 – General Requirements.
2. Division 21 – Fire Protection Piping and Special Hazard Systems.
3. Division 22 – Plumbing.
4. Division 23 – HVAC.
5. Division 26 – Electrical.

1.4 REGULATORY REQUIREMENTS

A. Permits, Licenses & Fees
1. Obtain and pay for all required permits, licenses, and inspection fees for fire-protection work.
2. Secure any special operating permits required by the AHJ.
3. Provide proof of permit issuance and fee payment before beginning work.

B. Inspections & Witness Testing
1. Coordinate and schedule all rough-in and final inspections with the AHJ's Fire Marshal or designated inspector.
2. AHJ witnessing is mandatory for:
   a. Sprinkler hydrostatic tests (per NFPA 13).
3. Record inspection dates, inspector names, and any required remedial actions; submit to the Engineer immediately.

C. Shutdown & Impairment Procedures
1. For any planned system shutdown or impairment, submit a written notification to the Owner and AHJ at least five (5) calendar days in advance.
2. Provide AHJ-approved temporary measures for the duration of the impairment.
3. Do not proceed with shutdown until receiving written owner and AHJ approval.

D. Certificates & Close-Out
1. After each inspection or test, obtain signed certificates of compliance from the AHJ and include them in the project close-out submittals.

2. Provide final third-party inspection reports, NFPA 25 inspection records, and proof of permit closure in the O&M manual.

E. Local Code Precedence
1. Where local or state code requirements adopted by the AHJ are more stringent than NFPA or IFC standards, the local requirements shall govern.

F. Continued System Availability
1. Maintain power, supervisory signaling, and sprinkler system integrity until final occupancy approval is granted by the AHJ.
2. Immediately restore any impaired systems at the end of each workday unless a written extension is granted by the AHJ.

1.5 PRODUCT REQUIREMENTS

A. Basis of Design:
1. Basis-of-design manufacturer for all fire-protection equipment (sprinklers, valves, etc.) shall be Victaulic / Tyco / Viking.
2. All items of similar equipment shall be products of the same manufacturer to ensure compatibility and simplified service.

B. Substitutions:
1. Comply with Division 01 Section “Product Requirements” for substitution procedures.
2. Contractor’s bid may be based on any manufacturers named; if bidding on “or-equal” products not listed, assume all coordination impacts and no added cost to Owner.
3. Where basis-of-design equipment dictates space, Contractor is responsible to verify “or-equal” equipment fits with required service clearances (maintenance and code). Submission of shop drawings constitutes that verification.
4. Electrical characteristics of listed equipment have been coordinated with Division 26; if substituted equipment has different voltage/amps, Contractor shall revise wiring, breakers, disconnects, and panel schedules at no cost to Owner. Written proof of coordination with the Electrical contractor must accompany the equipment submittal.
5. All substitution requests must be submitted in writing to the Architect at least 10 days prior to bid, including:
    a. Manufacturer, catalog, and model number of proposed substitute.
    b. Performance and dimensional data for comparison.
    c. Any required changes to other work.
    d. The burden of proof for “or-equal” compliance rests with the proposer; the Architect’s decision is final.

C. Value Engineering / Analysis (VE/VA):
1. If VE/VA is performed, Contractor shall notify all affected trades of any proposed product changes and include coordination impacts in their bids.
2. Contractor assumes responsibility for verifying that VE/VA offerings fit allocated spaces and meet maintenance/access requirements; shop drawings for VE/VA products imply such review.
3. Architect’s approval of VE/VA proposals is final; proof of merit rests with proposer.

D. Single Source Responsibility:
1. Where multiple devices form a system, furnish them from a single manufacturer to ensure matched performance and warranty.
2. Provide a manufacturer’s certification stating all supplied components are compatible and covered under a single warranty.

E. Coordination with Other Divisions:

1. Division 26 – verify electrical characteristics for pump motors, valve actuators, and alarm panels.
2. Division 23 – confirm HVAC/damper penetrations do not conflict with sprinkler piping layout.
3. Division 28 – ensure fire-alarm waterflow and supervisory switches match panel inputs.

1.6 SUBMITTALS

A. Division 01 Procedures:
1. Submit all submittals in accordance with Division 01 Section "Submittal Procedures." Use the project's digital platform and BIM Execution Plan naming conventions.

B. Hydraulic Calculations & Shop Drawings:
1. Fire-sprinkler hydraulic calculations and sprinkler shop drawings shall be prepared under the direction of a Professional Engineer licensed in the State of Alabama.
2. The Engineer shall sign and seal each drawing sheet and the cover sheet for the calculations, per the State Board of Professional Engineers and Land Surveyors and the State Fire Marshal requirements.

C. Product Data:
1. Submit a complete list of materials and equipment for all Division 21, Section 210450 fire-protection systems, including: manufacturer name, catalog/model number, dimensions, ratings, capacities, options, and applicable standards.
2. Highlight any deviations from the basis-of-design products.
3. Include performance curves for all pumps.
4. Do not place final equipment orders until submittals are returned as "No Exceptions Noted" or "Make Corrections Noted."
5. Submit electronically as PDF (exported—not scanned) files, one file per Section:
   a. Initial submittal to include an index of each equipment type.
   b. Subsequent submittals grouped by specification section; do not combine across sections.

D. Shop Drawings:
1. Before commencing work, submit detailed shop drawings (1/4″ = 1′-0″ scale) in PDF format showing:
   a. Fire-protection piping layouts, riser diagrams, fire-pump room plans, FDC locations, and valve/access door details.
   b. Structural penetration sleeve layouts for multi-story buildings (per Division 21 "Basic Fire Protection Materials and Methods").
2. Include elevations, clearances to ductwork and lighting, hanger/support details, and coordination notes with other trades.
3. Ensure submittals reference the latest approved contract drawings; failure to submit shop drawings will void responsibility protections for fit-up and piping conflicts.

1.7 COORDINATION DRAWINGS

A. General
1. Within 60 days of Notice to Proceed, submit Coordination Drawings covering all fire-protection work zones.
2. Coordination Drawings are purely for clash detection and will not be returned; the Architect will review for conflicts and notify the Contractor.
3. Do not base Coordination Drawings on simple reproductions of Contract Documents or catalog data.

B. Content
1. Draw project-specific information, accurately to scale, showing:

a. Spatial relationships and sequencing fire-protection elements in plenums, shafts, and finished spaces.
b. Critical dimensions from Contract Drawings and any conflicts with equipment clearances or architectural finishes.

2. Flag any conflicts or clearance issues and provide alternate sketches for resolution. Minor dimensional adjustments (≤ 1 in.) that do not affect system performance or code compliance are not considered Contract changes.

C. Format
1. Plan and reflected-ceiling views at a scale no smaller than 1/4″ = 1′-0″; include sections through congested areas for vertical-clearance verification.
2. Submit electronic files in native AutoCAD .dwg format (one discipline per file) and PDF prints.
3. Use a discipline-unique layering system separate from base wall/ceiling outlines.
4. Base CAD files and model sections will be provided by the Architect.

D. Shop-Drawing Database Workflow
1. Phase 1 – HVAC: HVAC subcontractor establishes the database with all ductwork, piping, equipment, floor drains, and motor electrical stub-ups.
2. Phase 2 – Plumbing: Plumbing subcontractor imports the HVAC database, adds all plumbing piping, controls, valves, and fixtures, then forwards to Fire Protection.
3. Phase 3 – Fire Protection: Fire Protection subcontractor imports the combined database, adds all fire-protection piping, sprinkler heads, valves, FDCs, and access panels, then forwards to Electrical.
4. Phase 4 – Electrical: Electrical subcontractor imports the full database, adds all conduits, fire-pump power, alarm wiring, and devices, then delivers to the General Contractor.

E. Final Coordination & Submission
1. General Contractor reviews the fully assembled coordination drawings, resolves all interdisciplinary conflicts in consultation with the Architect and subcontractors, and incorporates any remaining building elements.
2. Submit three (3) hard-copy sets and one complete electronic package (PDF and .dwg) of the final, coordinated shop drawings to the Architect on CD/USB.
3. The Architect will not review or process any trade shop drawings (including fire-protection) until the coordination drawings are approved floor-by-floor at a minimum.

1.8 QUALITY ASSURANCE

A. Installer Qualifications
1. Shall have a minimum of 3 years' documented experience installing fire-protection systems of similar size and complexity.
2. Shall have successfully completed at least 5 comparable projects within the last 5 years.
3. Installer personnel performing installation of systems shall be factory-trained and authorized by the respective equipment manufacturers.
4. A Professional Engineer, licensed in the State of Alabama, shall be responsible for reviewing and stamping all sprinkler shop drawings and hydraulic calculations.

B. Third-Party Inspection Agency
1. Engage a third-party inspection agency certified to NICET Level III (or higher) in water-based fire-protection inspection, or an AHJ-approved equivalent.
2. Submit signed inspection reports and certificates directly to the Engineer and Owner.

C. Manufacturer Field Service
1. Manufacturer's representative shall perform a minimum of two (2) on-site visits.

a. Rough-in inspection to verify correct installation of piping, hangers, and valve orientation.
b. Pre-commissioning review to confirm equipment set-up, clearances, and control wiring.

2. Provide a letter from the manufacturer confirming each field visit and noting any deviations or corrective actions.

D. Code Compliance
1. Installer shall comply with all applicable NFPA standards (NFPA 13, 14, 20, 25), IBC/IFC requirements, and local amendments adopted by the AHJ.
2. Equipment and materials shall be UL-listed or FM-approved for their intended use.

E. Training
1. Provide operation-and-maintenance training for Owner's personnel.
2. Deliver training documentation, attendance roster, and "hands-on" verification forms as part of close-out submittals.

1.9 DRAWING INTERPRETATION AND COORDINATION

A. General Intent
1. Contract Drawings indicate size, capacity, location, direction, and overall relationship of fire-protection systems. They do not show exact field dimensions or final routing.

B. Dimension Verification
1. Do not scale drawings to determine location of piping, hangers, or equipment.
2. Field-verify all dimensions and clearances against:
a. Architectural plans (ceiling grids, light fixtures, diffuser locations)
b. Structural elements (beams, columns, slabs)
c. MEP drawings (ductwork, plumbing, electrical)
d. Actual site conditions

C. Field Adjustments
1. Make minor field adjustments to piping routes, sprinkler-head locations, and access panels to optimize:
a. Ease of service and maintenance
b. System performance and flow characteristics
c. Aesthetic alignment with ceiling finishes and architectural features

D. Conflict Resolution & Clarifications
1. If discrepancies or ambiguities arise between drawings, specifications, or field conditions, submit a Request for Information (RFI) and obtain written clarification from the Architect/Engineer before proceeding.
2. Proceeding without written clarification transfers responsibility for any resulting conflicts or corrective work to the Contractor.

E. Reference to Architectural Drawings
1. Use architectural reflected-ceiling plans as the master reference for sprinkler-head and trim-plate centering around ceiling fixtures and grids.
2. Coordinate final head locations and escutcheon types with ceiling-finish conditions.

1.10 PROJECT / SITE CONDITIONS

A. Site Investigation
1. Prior to bidding, and again before starting work, visit the site to become fully familiar with existing conditions that may affect the fire-protection work, including access, clearances, and existing utilities.

2. No additional compensation will be allowed for work impeded by conditions that a reasonable site visit would have revealed.

B. Utility Verification
1. Locate, verify, and record sizes, inverts, and routes of all existing and proposed utilities affecting fire-protection systems.
2. Confirm fire pump suction and discharge connections are compatible with existing piping.
3. Update shop drawings and hydraulic calculations if utility conditions differ from contract documents.

C. Interference and Shutdown Coordination
1. Sequence work to minimize interruption of existing services. Any shutdown of fire-water, domestic water, or related utilities requires:
   a. Written approval from the Owner and AHJ at least five (5) days in advance.
   b. Provision of temporary services (portable pumps, standpipes, fire watches) as directed by the AHJ.
2. Coordinate shutdowns and outages with all affected trades—electrical, plumbing, HVAC, and structural—to avoid conflicts.

D. Protection of Existing Conditions
1. Protect existing site improvements, paving, landscaping, structures, and utilities from damage during fire-protection work.
2. Repair any damage to existing improvements at no cost to the Owner.
3. Maintain clean, safe work areas and remove debris daily.

E. Unforeseen Conditions
1. If concealed or unknown conditions are encountered that differ materially from contract documents, immediately notify the Engineer in writing before proceeding.
2. Obtain written instructions from the Engineer to address these conditions; do not proceed at Contractor's risk.

1.11 SUBMITTALS FOR PROJECT CLOSEOUT

A. On-Site Record Prints
1. Keep one set of prints on-site, updated daily with all corrections, variations, deviations, and Change-Order work to the fire-protection drawings.
2. Accurately show actual location, size, and elevation of all new exterior and interior fire-protection elements, dimensioned from permanent building features.
3. Record changes on the prints each day.
4. Before requesting final payment, submit the marked-up prints to the Architect for review.
5. Contractor shall prepare complete as-built record drawings reflecting all field-verified changes and submit them to the Engineer for review and approval.

B. Record Drawings & Closeout Data
1. Record Drawings: Provide PDF reproducibles and native AutoCAD (.dwg) files for all fire-protection piping and equipment layouts.
2. Equipment Submittal Data: Two (2) complete sets of final product data submittals (as-built configurations).
3. Operation & Maintenance Manuals: Two (2) complete O&M manuals covering all fire-protection equipment.
4. Warranties & Guarantees: Two (2) copies of all equipment warranty certificates and guarantees.
5. Training Roster: List of Owner's personnel who have received system operation and maintenance instruction.

C. Final Submission for Approval
   1. Prior to issuance of the Certificate of Final Payment, submit the following to the Architect for approval:

D. Material & Test Certificates
   1. Contractor's certified Material and Test Certificate for above-ground fire-protection piping.

E. Underground Piping Certificate
   1. Contractor's certified Material and Test Certificate for underground fire-protection mains.

PART 2 - PRODUCTS – Not Used.

PART 3 - EXECUTION – Not Used.

END SECTION 21 0451

SECTION 21 0452

IDENTIFICATION FOR FIRE PROTECTION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, including color and letter style.

1.3 QUALITY ASSURANCE

A. NFPA Compliance: Comply with applicable NFPA standards regarding labeling and signage for fire protection systems.

B. ASME Compliance: Pipe identification colors and labeling shall comply with ANSI/ASME A13.1.

1.4 COORDINATION

A. Coordinate installation of identification devices with completion of covering and painting of surfaces where devices are applied.

B. Coordinate installation with access panel and door locations.

C. Install identification prior to installation of acoustical ceilings and concealment.

D. In existing buildings, match existing labeling standards and methodology unless otherwise directed by the Architect.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Material: Multilayer, multicolor, mechanically engraved plastic, 1/16-inch thick, with predrilled holes or adhesive backing.

B. Color Coding: Red background with white letters for fire-protection equipment.

C. Minimum Size: 2-1/2 by 3/4 inch.

D. Minimum Letter Height: 1/2 inch.

E. Fasteners/Adhesives: Stainless-steel screws or permanent contact-type adhesive.

F. Content: Equipment designation or unique equipment number.

G. In existing buildings, match existing label format and numbering.

2.2 WARNING SIGNS AND LABELS

A. Material: Engraved plastic, 1/16-inch thick.

B. Color: Yellow background with white letters.

C. Size: Not less than 2-1/2 by 3/4 inch.

D. Letter Height: Minimum 1/2 inch (scaled for visibility).

E. Mounting: Stainless-steel fasteners or permanent adhesive.

F. Content: Caution and warning messages as indicated on the Drawings or Specifications.

2.3 PIPE LABELS

A. General: Preprinted, color-coded, with service lettering and flow direction.

B. Color Standards: Comply with ANSI/ASME A13.1 unless otherwise indicated.

C. Label Type: Snap-on semi-rigid plastic for pipes ≤ 6 in. diameter; strap-on type for larger pipes.

D. Content: Service identification and integral or separate directional arrows.

E. Lettering Height: Minimum 1-1/4 in. for pipe 2-1/2 in. and larger.

F. In existing buildings, match existing labeling format and color scheme.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean all surfaces of dirt, grease, paint, or other substances before applying labels or tags.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install permanent labels on all major fire-protection equipment and starters furnished under this Division. Labels shall be accessible and clearly visible.

3.3 WARNING-SIGNS AND LABELS INSTALLATION

A. Install warning signs and labels on equipment and system components as indicated.

3.4 PIPE LABEL INSTALLATION

A. Label fire-protection mains and associated piping in accordance with ASME A13.1.

B. Locate labels at the following:
1. At each valve and control device.
2. At branch connections.
3. At wall, floor, or ceiling penetrations.
4. At changes in direction.
5. At access points (doors, manholes, tunnels).
6. At equipment connections and system terminations.
7. At intervals not exceeding 20 feet on exposed piping runs.

END OF SECTION 21 0452

SECTION 21 0453

BASIC FIRE PROTECTION MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes common materials, accessories, and general installation requirements for fire-protection systems, including:
1. Piping materials and joining methods common to fire-protection systems.
2. Mechanical sleeve seals.
3. Sleeves and penetrations.
4. Concrete and grout.
5. Escutcheons.
6. Building access doors.
7. Flashing.
8. Workmanship.
9. Cutting and patching.
10. Excavation, trenching, and backfilling.
11. Piping systems installation – common requirements.
12. Equipment installation – common requirements.
13. Painting and finishing.
14. Supports and anchorages.
15. Protection and cleaning of equipment and materials.

1.2 DEFINITIONS

A. Finished Spaces: Occupied, architectural spaces.

B. Exposed, Interior Installations: Visible in occupied interiors and mechanical/electrical rooms.

C. Exposed, Exterior Installations: Visible outdoors, subject to weather.

D. Concealed, Interior Installations: Above ceilings, in chases, or concealed from view.

E. Concealed, Exterior Installations: Concealed from view but subject to ambient outdoor temperatures.

F. Abbreviations:
1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

1.3 SUBMITTALS

A. Product Data: For sleeve seals, escutcheons, access doors, and accessories.

B. Informational Submittals: Sleeve drawings for multi-story buildings indicating size, location, and pipe service.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes with factory end caps; maintain caps until installation.

B. Store plastic pipe protected from sunlight; support to prevent sagging.

1.5 COORDINATION

A. Coordinate chases, sleeves, and openings with structure and other trades.

B. Coordinate building access doors with concealed valves and devices.

C. Coordinate final electrical characteristics of fire-protection equipment with Division 26 before ordering equipment.

PART 2 - PRODUCTS

2.1 PIPE, TUBE AND FITTINGS

A. Refer to individual Division 21 piping sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe.

2.2 JOINING MATERIALS

A. Flange gaskets: ASME B16.21 or AWWA C110, asbestos-free, appropriate to service.

B. Bolts/Nuts: ASME B18.2.1, carbon steel unless noted otherwise.

C. Solder/Brazing filler metals: Lead-free per ASTM B32 / AWS A5.8.

D. Solvent cements: ASTM D2564 (PVC), ASTM F493 (CPVC); VOC limits per LEED requirements when applicable.

2.3 MECHANICAL SLEEVE SEALS

A. Modular interlocking sealing elements with pressure plates and bolts, EPDM or equivalent.

B. Provide U.L. fire-rated assemblies at fire-rated wall penetrations.

C. Manufacturers: Calpico, APS Innerlynx, Link-Seal, Metraflex, Pipeline Seal & Insulator.

2.4 SLEEVES

A. Galvanized sheet-metal sleeves for partitions.

B. Schedule 40 steel pipe sleeves for structural concrete.

C. Firestopping sealants: Refer to Division 07.

D. Stuffing insulation: Non-combustible glass fiber.

2.5 CONCRETE AND GROUT

A. Concrete: 3000 psi min. compressive strength.

B. Grout: ASTM C1107, non-shrink, non-metallic, 5000 psi design strength.

2.6 ESCUTCHEONS

A. Chrome-plated manufactured wall, ceiling, and floor plates sized to cover annular space around piping.

2.7 ACCESS DOORS – BUILDING

A. 14-gauge steel doors with 16-gauge steel frames, concealed hinge, screwdriver cam latch, prime coated.

B. Fire-rated where installed in rated construction.

C. Manufacturers: Bilco, Milcor, Nystrom.

2.8 FLASHING

A. Flexible sheet butyl flashing, 47 mil thick.

B. Lead sheet, 5 lb/SF for waterproofing.

C. Pitch cups: 20-gauge galvanized steel.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. First class and in accordance with best practice. Work to be orderly, neat, workmanlike in appearance and performed by skilled craftsman.

B. Poor or improper workmanship shall be removed and replaced as directed by the Architect without additional cost to the Owner or design professionals.

3.2 CUTTING AND PATCHING

A. Comply with the requirements of other Divisions for the cutting and patching required to accommodate the installation of Fire Protection work. Repair and finish to match surrounding.

B. Architect's approval required before cutting any part where strength, or appearance of finished work is involved.

C. Openings are to be laid out and built-in, set sleeves and inserts and furnish detailed layout drawings to other trades in advance of their work.

D. Core drill or saw cut openings in existing masonry construction.

3.3 EXCAVATION, TRENCHING AND BACKFILLING

A. Perform excavation/backfill per Division 31 "Earthwork."

B. Provide 6 in. bedding below piping; backfill with sand/fine gravel.

C. Compact to 95% density under pavements; restore surfaces to match existing.

3.4 PIPING SYSTEMS INSTALLATION - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 21 Fire Protection Piping Sections specifying piping systems.

B. Drawings, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas and stairwells.

D. Install piping indicated to be exposed and in service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections. No mitering or notching for fittings permitted.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install escutcheons where exposed piping penetrates walls, ceilings, and floors in finished spaces.

3.5 SLEEVES

A. Sleeves are not required for core-drilled holes.

1. In mechanical room floors and other potentially wet areas, provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
   1. Cut sleeves to length so that sleeve extends out ½ inch from both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas, or other potentially wet areas, 1-1/2 inches above finished floor level. Caulk space outside of sleeves water tight.
   2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
   3. Use the following sleeve materials:
      a. Sleeves for Piping Through Concrete Beams, Concrete Walls, Footings, and Potentially Wet Floors: Steel pipe.
      b. Sleeves for Piping Through Masonry Walls and Gypsum Board Partitions: 22 gauge galvanized sheet metal sleeves 1/2 inch larger than pipe or pipe covering.
   4. Where piping penetrates non-rated equipment room wall, floors or roofs outside of a shaft, close off space between pipe and adjacent work with stuffing insulation and caulk air tight.
   5. Above ground, non-rated, exterior wall penetrations: Seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
   6. Seal space around the outside of sleeves with grout at masonry walls and floors and dry wall mud at gypsum board partitions.

C. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
   2. Fill void between pipe and sleeve with urethane foam and water proof around pipe on below grade end.

D. Fire-Rated Penetrations: Where pipes pass through fire-rated and fire-resistive floors, walls, and partitions, install appropriately rated sleeves and firestopping sealant. Firestopping materials and installation methods are specified in Division 07 Sections “Through Penetration Firestop Systems” and “Fire Resistive Joint Systems”.

3.6 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 21 Fire Protection Piping Sections specifying piping systems.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

D. Flanged Joints:
   1. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.

3.7 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 PIPE CLEANING

A. Keep pipe clean and free of dirt. Keep caps on ends of pipe when it is stored on site and reinstall caps on ends of installed piping at the end of each day.

3.9 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

D. Install equipment in accordance with manufacturer's instructions. If manufacturer's instructions conflict with Contract Documents, obtain Architect's decision before proceeding.

E. Install equipment to allow right of way for piping installed at a required slope.

F. All equipment shall be firmly fastened in place:
   1. Pad mounted equipment shall be secured to pads using poured in place anchor bolts or cinch anchors.
   2. Vibration isolators shall be secured to floors or pads and equipment shall be bolted to the isolators.

3.10 PAINTING AND FINISHING

A. Except as specified below or noted on the Drawing, requirements for painting of Fire Protection systems, equipment, and components are specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.11 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" requirements.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing and fire protection materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.12 GROUTING

A. Mix and install grout for Fire Protection equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.13 ACCESS DOORS – BUILDING

A. Provide access doors in wall and inaccessible ceilings to allow access to service and maintain concealed equipment, valves, etc.

B. Coordinate installation of access doors with Divisions responsible for Building System in which panels are being installed.

3.14 FLASHING

A. Provide flexible flashing and metal counterflashing where pitch cups and piping penetrate weather or waterproofed walls, floors and roofs.

3.15 PROTECTION AND CLEANING OF EQUIPMENT, FIXTURES, AND MATERIALS

A. Protect equipment and piping from weather, dust, and damage during construction.

B. Keep pipe ends capped until final installation.

C. Clean all exposed materials and equipment prior to turnover.

END SECTION 21 0453

SECTION 21 0455

FIRE PROTECTION SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fire protection system(s) including design-assist, materials, shop drawings, installation, identification, controls/interfaces, acceptance testing, certification, training, and closeout for the following where shown:
   1. Underground fire service and in-building riser.
   2. Wet-pipe sprinkler systems.

1.2 RELATED SECTIONS

A. Section 210451 – General Fire Protection Requirements.

B. Section 210452 – Identification for Fire Protection Piping and Equipment.

C. Section 210453 – Basic Fire Protection Materials and Methods.

1.3 CODES, LISTINGS, & AUTHORITY HAVING JURISDICTION (AHJ)

A. Comply with AHJ-adopted editions of NFPA 13/14/20/24/25, NFPA 72, and (clean agent) NFPA 2001; compressed gas cylinders per NFPA 55; electrical per NFPA 70.

B. All system components shall be UL Listed and/or FM Approved (where required) for the intended service, installed per their listings.

C. Jurisdiction Note: This specification defaults to City of Dothan, Alabama practices.

1.4 PERFORMANCE & DESIGN BASIS

A. Hydraulic Method (Sprinklers): Area/Density unless otherwise indicated by design drawings. Include hose allowance.

B. Default Remote Area & Density:
   1. Light Hazard (offices, patient rooms, corridors): 0.10 gpm/sf at 1,500 sf + 100 gpm hose.
   2. Ordinary Hazard Group 1 (small mech./elec ≤250 sf, kitchens without hoods): 0.15 gpm/sf @ 1,500 sf + 250 gpm hose.
   3. Ordinary Hazard Group 2 (loading, larger elec/mech, storage <12 ft): 0.20 gpm/sf @ 1,500 sf + 250 gpm hose.
   4. Storage >12 ft: Design per commodity/arrangement.

C. Supply Margin: Peak system demand (incl. hose) ≥ 10% below the available supply curve used for design.

D. Freezing Conditions: Use dry/preaction or listed heat-trace and insulation.

1.5 SYSTEM TYPE

A. New Construction: Provide a complete, new **wet** system throughout the **building**, fully compliant with NFPA as applicable and the AHJ's adopted editions.

1.6 SUBMITTALS FOR REVIEW

A. Product Data: Submit to the Architect and obtain his approval of a complete list of materials and equipment which are to be furnished under Division 21.
   1. List shall be complete with manufacturer's names, catalog number, dimensions, specifications, rating data and options utilized. Capacities shall be in the terms specified.

2. Call attention to deviations from specified items as to operation and physical dimensions.
3. Grooved joint couplings and fittings may be shown on drawings and product submittals, and shall be specifically identified by the manufacturer's style or series designation.
4. Performance curves for equipment such as pumps shall be included.
5. Final equipment orders shall not be placed until submittals have been returned marked "No Exceptions Noted" or "Make Corrections Noted".
6. Bind all equipment submittals and provide index tab for each type of equipment. Submit all at one time. Reserve two sets for project close-out documents.

B. Shop Drawings:
1. A reflected ceiling plan indicating locations of sprinkler heads, lights, HVAC devices, smoke detectors, exit lights and any additional items attached to ceiling. In lift out ceilings, sprinkler heads are to be centered in ceiling tiles. In hard ceilings, sprinkler heads to follow the general arrangement of the ceiling. After review by the Architect, revise layout as required.
2. Prepare a working pipe shop drawing based on hydraulic calculations. The piping shop drawing shall indicate routing and configuration of piping, size of pipe, piping support, elevation of piping and coordination of piping with ductwork. Shop drawings shall include low point drain downs.
3. Hydraulic calculations are to be prepared utilizing a current water flow test (maximum 90 days old). If current flow test is not available, obtain a current flow test and pay for all fees required.
4. Sprinklers shall be referred to on drawings and other documentation by the manufacturer's model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations are not permitted.
5. Sprinkler head schedule shall clearly indicate the temperature rating of each sprinkler type to be provided. Submittals that do not include temperature rating data for each head will be considered incomplete.
6. If water flow information is not available due to new main extension or other construction which prohibits the availability of flow information at the start of construction, the contractor shall estimate probable flow information based on information available. Once permanent water is available at the site, the Contractor shall perform a flow test, incorporate the information into the calculation and make any modifications to the system as may be required.
7. When allowed by local and state authority having jurisdiction, calculations may be calculated from fire pump or standpipe given current flow data of pump and fire riser is provided. Fire pump and/or standpipe test to be within 1 year. A head replacement plan will not be accepted.
8. When drawings and hydraulic calculations are submitted to the Engineer for review, they shall bear the seals of review and approval of the Architect, General Contractor, the Owners Insurance Underwriter. Hydraulic calculations and sprinkler shop drawings for building fire protection systems must be prepared under the supervision of an engineer licensed in the State of Alabama and bear his/her licensure seal with signature and date.
9. The Contractor shall incorporate all comments for approval by local Fire Marshall's Office and any State of Alabama Reviewing Agency. Contractor shall provide signed, sealed and approved set of plans to Engineer upon approval by state and local authorities.
10. Each system calculations, components and alarming to be on shop drawings. Refer to following sections for Special Hazard Systems.

1.7 QUALITY ASSURANCE & COORDINATION

A. BIM/Coordination: Provide coordinated MEPFP models/drawings (1/4″=1′-0″ in congested zones). Show clearances, valve access, test/discharge routing, seismic sway spaces.

1.8 DELIVERY, STORAGE, HANDLING

A. Cap pipe ends; store sprinklers in cases until install; protect finishes; keep valves/devices dry/indoors.

1.9 EXTRA MATERIALS

A. Spare sprinklers/wrenches/cabinet per NFPA 13 (quantities by temp/finish).

B. Six (6) spare recessed and six (6) spare concealed escutcheons per type/finish.

C. Twelve (12) spare head guards (if used).

D. Two (2) sight-glass kits for test & drain assemblies.

PART 2 - PRODUCTS

2.1 PIPING BELOW GRADE AND BELOW SLAB ON GRADE

A. Pipe: Ductile Iron Class 50/51/52, cement-mortar lined (AWWA C151/C104), asphaltic exterior.

B. Fittings & Joints: Ductile iron mech. joint fittings; restrained joints/retainer glands as required; thrust blocks per calc/soil; locator tape and #10 AWG tracer wire continuous to In-building riser and fire department connection.

C. In-Building Riser: Fabricated elbow/riser fitting, listed, with CIPS/grooved ends; no field alteration. Where an in-building riser is not feasible, provide restrained ductile iron lead-in with wall sleeve/seal.
   1. Manufacturer:
      a. Ames IBR.

2.2 ABOVE GROUND PIPING

A. Wet Systems: ASTM A53/A795/A135 steel; Sch 10 roll-grooved or Sch 40 threaded/grooved; grooved per manufacturer.

B. CPVC: Not permitted unless explicitly noted; if used in tenant or special areas, pipe/fittings listed for FP, orange CPVC, compatible heads/adapters.

C. Joints: Threaded per ASME B1.20.1 with listed compound/tape; flanged per ASME B16.5 with listed gaskets; grooved per listing.

D. All piping shall be pitched to drain down at low points. Pipe all drains associated with low points to AHJ's preferred location. Coordinate drain locations with Architect.

2.3 SPRINKLERS, ESCUTCHEON, & FLEXIBLE DROPS

A. Sprinkler Heads (All sprinklers shall be UL/FM approved for the designed location and use):
   1. Quick Response Recessed Pendent, K-Factor 5.6, Chrome Finish.
      a. Manufacturers:
         1) Viking VK102. Reliable, Tyco, Globe, and Victaulic are approved equals
   2. Quick Response Concealed Pendent, K-Factor 5.6, White Finish.
      a. Manufacturers:
         1) Reliable G5. Viking, Tyco, Globe, and Victaulic are approved equals
   3. Upright, K-Factor 8.0, Bronze Finish with Head Guard.
      a. Manufacturers:
         1) Tyco TY-B. Viking, Reliable, Globe, and Victaulic are approved equals

B. Special Heads:
   1. MRI non-ferrous concealed pendent.
      a. Manufacturer:
         1) Reliable F4FR-NF. Adjust temperature as calculated.
   2. Window Sprinklers
      a. Manufacturer:
         1) Tyco Model WS, installed per listing/glass geometry.

3. Cleanroom/OR sealing heads.
    a. Manufacturer:
        1) Viking VK462.

C. Flexible Drops:
1. Braided stainless with listed bracket; include equivalent length in calcs; adhere to max bends/min radius; use seismic-rated kits where required. These flexible connections may be required for seismic, ease of installation, tenant flexibility, Owner, or specific sprinkler location requirements. The use of other UL/FM approved devices manufactured by other than Victaulic is not acceptable to achieve the seismic requirements for this project. Flexible sprinkler drops shall be installed in strict accordance to their listings as published by the manufacturer's instructions. Particular attention to the minimum radius of each bend as well as, the number of bends allowed installed in a single flexible drop. This shall be under close scrutiny during the installation process. Victaulic's representative shall periodically visit the job site and review installation. Each flexible drop not properly installed as determined by engineer or Victaulic shall be replaced by the Contractor at no additional cost to the Owner, General Contractor, or Engineer of Record.
    a. Manufacturer:
        1) Victaulic VIC-FLEX AH2

2.4 VALVES, DEVICES, ASSEMBLIES

A. Floor Control Assembly (each zone): Supervised OS&Y or supervised butterfly valve, check valve, waterflow switch to FA, and test & drain with sight glass/orifice.
1. Manufacturer:
    a. Victaulic TestMaster II Style 720 or Viking A-1.

B. Gate Valves:
1. Up to and including 2 Inches:
    a. Bronze body, bronze trim 175 psi WP, UL Listed, rising stem, handwheel, solid wedge or disc, threaded ends.
    b. Manufacturer:
        1) Nibco T-104-O. Victaulic, Watts, Tyco and Milwaukee are approved equals.
2. Over 2 Inches:
    a. OS&Y Iron body, bronze trim 175 psi WP, UL Listed, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid bronze or cast iron wedge, flanged or grooved ends.
    b. Manufacturer:
        1) Nibco F-607-OTS. Victaulic, Watts, Tyco and Milwaukee are approved equals

C. Butterfly Valves:
1. Cast or ductile iron, chrome or electroless-nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM pressure responsive seat, lug, or grooved ends, and stainless steel stem. (Stem shall be offset from the disc centerline to provided complete 360-degree circumferential seating.) Valve shall have an extended neck, handwheel and weatherproof actuator housing with gear drive and integral indicating device, and internal tamper switch rated, UL / FM approved.
    a. Manufacture:
        1) Nibco Model GD-4765-4/8. Victaulic, Watts, Tyco and Milwaukee are approved equals.

D. Check Valves:

1. Iron body and swing disc, bronze seat, stainless steel spring, grooved ends, 250 psi WP; suitable for vertical or horizontal installation.
    a. Manufacturer:
        1) Nibco Model G-917-W. Victaulic, Watts, Tyco and Milwaukee are approved equals

E. Alarm Check Valve:
1. Complete with retard chamber, drains, gages, by-passes and all accessories required to prevent accidental alarms due to fluctuations in system pressure and testing of the valve while in service. Provide both mechanical and electrical means for actuation of Fire Alarm. Pipe all drains full size to AHJ's preferred location. The alarm check valve's internal components shall be replaceable without removing the valve from the installed position.
    a. Manufacturer:
        1) Victaulic 751 grooved end valve / Viking J-1 flanged valve.

F. Water Motor Alarm:
1. Hydraulically operated impeller type alarm with aluminum alloy chrome plated gong and motor housing, nylon bearings, and inlet strainer.
    a. Manufacturer:
        1) Victaulic Series 760.

G. Fire Department Valve:
1. 2-1/2 Inch pressure regulating angle hose valve with cap and chain at locations where pressure exceeds 65 psi. Outlet threads shall match that of the local fire department.
    a. Manufacturer:
        1) Croker 5000 Series.

H. Fire Department Siamese Connection:
1. Chrome plated exposed with clappers, caps and chains.
    a. Manufacturer:
        1) Crocker Figure No. 6410-PC.
2. Location to be coordinate with Fire Chief and Architect.
3. At the low point near each fire department connection, install a 90-degree elbow with drain connection to allow for system drainage to prevent freezing. Basis of Design: Victaulic #10-DR.

2.5 RISER MANIFOLD

A. Working pressure is 175 PSI equipped with; water flow switch, ball valve, test and drain, valve with properly sized test orifice, and sight glass. Provide optional pressure relief valve for grid system installation.
1. Manufacturer:
    a. Tyco Model 513

2.6 HANGERS AND SUPPORTS

A. Pipe Hangers and Supports:
1. Conform to NFPA 13.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.

8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Plate Support: Carbon steel ring, adjustable, copper plated.
10. All hangers to be a maximum of 12 inches from all 90 deg ells, the end of a branch line and mains, or an arm-over for drop.

2.7 FIRE STOP SYSTEMS

A. All wall and floor penetrations are to be closed. Refer to the Arch. Life Safety Plans and close all openings with a U.L. listed assembly compatible with the rating of the wall or floor being penetrated.

B. Non-rated walls – sheet rock joint compound may be used to seal opening.

C. For piping passing through listed sheet rock walls or partitions:
1. Uninsulated pipe passing through 2 hour walls or partitions – minimum 5/8" depth of Hilti FS 605 filling annular space between wall and pipe on both sides of wall. U.L. Listing #WL1056.
2. Uninsulated pipe passing through 2 hour walls or partitions – minimum 1-1/4" depth of Hilti FS 601 filling annular space between pipe and wall on both sides of wall, U.L. Listing #WL1054.

D. For piping passing through concrete floors, concrete walls or concrete block walls.
1. Uninsulated Schedule 40 steel pipe; fill annular space between pipe and opening with Hilti #FS 605. U.L. Listing #CJ1184.

PART 3 - EXECUTION

3.1 PREPARATION

A. Codes & Standards
1. Install fire protection piping in accordance with the AHJ-adopted editions of: NFPA 13 (sprinkler), and NFPA 24 (private service mains).
2. Where requirements conflict, the most stringent governs unless directed otherwise by the AHJ.

B. Utility Interface
1. Connection to Site Fire Service: Coordinate and connect to the site fire service installed under other sections. Verify size, material, elevation, and location against the Civil drawings before starting work.

C. Piping Layout & General Installation
1. Route piping neatly, plumb, and parallel/perpendicular to structure; conserve space and maintain required slopes/gradients.
2. Group piping at common elevations where practical.
3. Provide flexibility and guides so thermal movement does not stress pipe, joints, or connected equipment.
4. Install to maintain service access to valves, devices, and equipment.

D. Grooved Piping
1. Install grooved joints per coupling manufacturer's written instructions.
2. Pipe ends shall be clean, square, and free of indentations/roll marks.
3. Use listed gaskets suitable for the service; gaskets shall be by the coupling manufacturer.
4. Provide manufacturer-authorized on-site training for field crews on grooving/installation. Manufacturer's technical representative shall make periodic quality visits. *(Distributor-only reps are not acceptable for training.)*

E. Inserts, Hangers, and Supports
1. Inserts:

a. Provide embeds/inserts in new concrete for future supports; coordinate locations prior to placement.
b. For pipes >4 in., provide hooked rods or equivalent reinforcement as required.
c. Where slabs are exposed ceilings, set inserts flush with the finished surface.

2. Hangers/Supports:
a. Design, locate, and install per NFPA 13 / NFPA 14 and the hanger manufacturer's listings.
b. Support vertical risers at each floor and independently of horizontal branches.
c. Multiple parallel pipes may use trapeze hangers where permitted.
d. Provide compatible hangers for copper or CPVC where used (no dissimilar-metal corrosion).
e. Finish of hangers/supports per Division 05/09; components in concealed interstitial spaces are not considered "exposed" for painting.

F. Drainage & Low Points
1. Slope mains 0.25 in. per 10 ft minimum and branches 0.50 in. per 10 ft minimum, unless otherwise required (e.g., refrigerated spaces 0.50 in. per 10 ft for all).
2. Arrange systems to drain at low points and provide auxiliary drains (drum drips) where required.
3. Penetrations, Sleeves, and Firestopping
4. Do not penetrate structural members unless indicated.
5. Provide sleeves at floor/wall penetrations; size to maintain clearances/insulation.
6. Firestop penetrations to the fire-resistance rating of the assembly using listed systems (see Division 07).
7. Seal non-rated penetrations airtight and watertight where exposed to weather or wet areas.

G. Surface Preparation & Touch-Up
1. Prepare pipe, fittings, supports, and accessories for finishes per Division 09.
2. Where support members are field-welded to building steel, clean and apply one coat zinc-rich primer to welds.

H. Joints, Valves, and Appurtenances
1. Threaded joints: cut NPT taper threads; clean and apply PTFE tape or PTFE compound to male threads only.
2. Install valves with stems upright or horizontal (not inverted) and provide shut-off/isolation where indicated and at logical sectional points.
3. Provide drain valves at main shut-offs, low points, and equipment as required.

I. Material Compatibility
1. When multiple piping materials are used, provide listed transition fittings and ensure full system compatibility.
2. Provide flanges/unions/couplings at equipment to facilitate service.

J. Attic/Unconditioned Spaces
1. Where piping is installed in attics or other freezing environments, provide dry/preaction solutions only as permitted by NFPA 13 and the AHJ.
2. If insulation is used to mitigate freezing, do not allow insulation to bear on piping; maintain clearances per listing/manufacturer.

K. Sprinkler Devices – Handling & Selection
1. Do not install any sprinkler that is dropped, damaged, shows fluid loss, or has a cracked bulb.
2. Remove protective caps/guards by hand only.

3. Response Type: Provide quick response sprinklers for Light Hazard and Ordinary Hazard areas unless plans/code indicate otherwise.
4. Finishes: Sprinklers in finished ceilings/walls: chrome with matching recessed escutcheons unless otherwise noted.
5. Shell/Spec Suites: Where “sprig-ups” are not used, provide minimum 1″ outlets with hex bushings at branch lines to accommodate future modifications.
6. Temperature Ratings: Select per NFPA 13 tables based on proximity to heat sources. Do not up-rate sprinklers generically unless specifically required by NFPA 13 or the AHJ.
7. Ceiling Coordination: In 2′×2′ and 2′×4′ ACT ceilings, center sprinklers in the tile. (Flexible drops/return bends as needed.) Exceptions: toilets, janitor closets, storage rooms, and kitchens—locate ≥6 in. from tee bars.

L. Protection of Installed Sprinklers
1. Prior to substantial completion or Owner occupancy (whichever is later), protect installed sprinklers from overspray, dust, and airborne contaminants from construction (texture, sealers, primers, paints, etc.). Remove protection only when risk has passed.

END OF SECTION 21 0455

SECTION 22 0401

GENERAL PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general plumbing requirements. Applies to all Division 220400 sections.

1.2 DEFINITIONS

A. "Provide" means to furnish and install, complete and ready for operation.

1.3 REFERENCES

A. ANSI: American National Standards Institute, Inc.

B. ASHRAE: American Society of Heating, Refrigeration, and Air Conditioning Engineers.

C. ASME: American Society for Mechanical Engineers.

D. ASSE: American Society of Sanitary Engineers.

E. ASTM: American Society of Testing and Materials.

F. AWWA: American Water Works Association.

G. CISPI: Cast Iron Soil Pipe Institute.

H. FM: Factory Mutual.

I. NAIMA: North American Insulation Manufacturers Association.

J. NEMA: National Electrical Manufacturers Association.

K. NFPA: National Fire Protection Association.

L. NSF: National Sanitation Foundation.

M. MSS: Manufacturers Standardized Society of the Valve and Fittings Industry.

N. PDI: Plumbing and Drainage Institute.

O. UL: Underwriters Laboratories, Inc.

1.4 REGULATORY REQUIREMENTS

A. Comply with current edition, unless otherwise noted, of the following codes and standards:
   1. ASME B31.9 – Building Services Piping.
   2. ADA – American's with Disabilities Act.
   3. NFPA 70 – National Electrical Code.
   4. NFPA 101 – Life Safety Code.
   5. IBC – International Building Code with Fire, Mechanical, Plumbing, and Gas Codes; 2015 Edition.
   6. International Energy Conservation Code: 2015 Edition.
   7. Alabama Boiler and Pressure Vessel Code.
   8. Local Health Department.

B. Permits, Licenses, Inspections and Fees:
   1. Obtain and pay all permits, licenses, inspections and fees, and comply with all rules, laws and ordinances pertaining to the Contractor's portion of the Work.
   2. Obtain and pay for certificates of required inspections, and file certificates with Owner.

1.5 PRODUCT REQUIREMENTS

A. Provide new standard, materials throughout.

B. Multiple items of similar equipment shall be the product of the same manufacturer.

C. Substitutions:
   1. Comply with the provisions of Division 01, Section "Product Requirements" and the following.
   2. When several manufacturers are named in the specifications, the corresponding products and models made by the specified manufacturers will be accepted and Contractor may base his bid on any one of those products. However, if the Contractor's bid is based on products other than the scheduled or specified **basis of design**, it shall be understood that there will be no extra cost involved whatsoever, and the effect on other trades has been included in the Contractor's proposal. Coordination with other trades for substituted equipment or use of products other than the named basis of design shall be the responsibility of the Contractor furnishing the equipment.
   3. The basis of design manufacturer's equipment has been used to determine space requirements. Should another approved manufacturer's equipment be used in preparing proposals, Contractor shall be responsible for determining that said equipment will fit space allocated. Submission of shop drawings or product data on such equipment shall be considered as indicating that the Contractor has reviewed the space requirements and the submitted equipment will fit the space allocated with due consideration given to access required for maintenance and code purposes.
   4. The basis of design manufacturer's equipment and scheduled Plumbing equipment electrical requirements have been used to coordinate the electrical requirements of the plumbing equipment with the electrical systems serving that equipment.
      a. Contractor shall coordinate the electrical requirements of the equipment actually furnished on this project and provide the electrical systems required by that equipment at no additional cost to the Owner.
      b. Equipment of higher or lower electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at no additional cost to the Owner.
      c. Prior to approval of submittals of plumbing equipment with electrical requirements that are greater or lower than those shown on the Drawings, Contractor shall submit letter verifying that required changes to the electrical system, serving the specific piece of equipment in question, have been coordinated with the electrical contractor. Letter to be included with the associated equipment submittal, addressed to the Architect with a copy to the electrical engineer.
      d. If minimum energy ratings or efficiencies are specified, equipment shall comply with specified requirements.
   5. Each Bidder may submit to the Architect a list of any substitutes which he proposes to use in lieu of the equipment or material named in the specifications with a request for the approval of proposed substitutes. To be considered, such requests must be delivered to the office of the Architect not later than 10 days prior to bid due date. The submittal shall include the following:
      a. Specific equipment or material proposed for substitution giving manufacturer, catalog and model number.
      b. All performance and dimensional data necessary for comparison of the proposed substitute with the equipment or material specified.
      c. A statement setting forth any changes in other materials, equipment or other Work that incorporation of the substitute may require.
   6. The burden of proof of the merit of the proposed substitute is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution is final.

1.6 SUBMITTALS

A. Submit under provisions of Division 01, Section "Submittal Procedures" and the following.

B. Product Data: Submit to the Architect and obtain his approval of a complete list of materials and equipment which are to be provided under the 220400 Sections of Division 22.
   1. List shall be complete with manufacturer names, catalog number, dimensions, specifications, rating data and options utilized. Capacities shall be in the terms specified.
   2. Call attention to deviations from specified items as to operation and physical dimensions.
   3. Include performance curves for pumps.
   4. Final equipment orders shall not be placed until submittals have been returned marked "No Exceptions Noted" or "Make Corrections Noted."
   5. Bind all equipment submittals and provide index tab for each type of equipment. Submit all at one time. Reserve two sets for project Close-Out Documents.

C. Shop Drawings: Before starting work, submit and obtain approval from Architect of detailed drawings of the following, fully dimensional (including elevations of ductwork and piping) and drawn to 1/4" to 1'-0" scale. Submit electronic file of each drawing in PDF format. Engineer will return electronic copy of marked-up drawings. Failure to submit shop drawings will make the Contractor responsible for changes required to facilitate installation.
   1. For multi-story buildings, submit detailed floor penetration sleeve layout drawings. See Division 22, Section "Plumbing Basic Materials and Methods," Article "Informational Submittals."

1.7 QUALITY ASSURANCE

A. Installer's Qualifications: Firm experienced in installation of systems similar in size and complexity to those required for this project, plus the following:
   1. Acceptable to, or licensed by, manufacturer.
   2. Not less than 3 years experience with systems.
   3. Successfully completed no less than 5 comparable scale projects using systems similar to these for this project.
   4. Current Master Plumbing's Certificate and Master's Gas Certificate issued by the State, County, and City in which the work occurs.

1.8 SUMMARY OF WORK

A. Scope: Provide all labor, materials, equipment and services necessary for the completion of all plumbing work shown or specified, except work specified to be done or furnished by others, complete and ready for operation.

B. Equipment Furnished by Others:
   1. Connect to all equipment shown on plumbing drawings that require plumbing connections.
   2. Provide piping, shut-off valves, and unions required for a complete installation.
   3. Equipment furnished by others include:
      a. Casework.
      b. Ice machines.
      c. Coffee makers.
      d. Refrigerators

1.9 DRAWING INTERPRETATION AND COORDINATION

A. Drawings are intended to show size, capacity, approximate location, direction and general relationship of one phase to another, but not exact detail or arrangement.

B. Do not scale drawings for location of system components. Check all measurements, location of pipe, ducts, and equipment with the detail architectural, structural, and electrical drawings and conditions existing in the field and lay out work so as to fit in with ceiling grids, lighting and other parts.

C. Make minor adjustments in the field as required to provide the optimum result to facilitate ease of service, efficient operation, and best appearance.

D. Where doubt arises as to the meaning of the drawings and specifications, obtain the Architect's written decision before proceeding with parts affected; otherwise assume liability for damage to other work and for making necessary corrections to work in question.

E. Refer to Architectural Drawings for all dimensions.

1.10 PROJECT / SITE CONDITIONS

A. Visiting Site: Visit site and become familiar with location and various conditions affecting work. No additional allowance will be granted because of lack of knowledge of such conditions.

B. Determine sizes, locations, and inverts of existing and new utilities near site.

C. Cause as little interference or interruption of existing utilities and service as possible. Schedule work which will cause interference or interruption in advance with Owner, authorities having jurisdiction, and all affected trades.

1.11 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit under provisions of Division 01, Sections "Closeout Procedures" and "Project Record Documents" and the following.

B. Record Drawings:
1. Keep accurate record of corrections, variations, and deviations, including those required by change orders to the Plumbing drawings.
2. Accurately show location, size and elevation of new exterior work dimensioned from permanent structure.
3. Record changes daily on a set of prints kept at the job site.
4. Submit prints marked as noted above to Architect for review prior to request for final payment.
5. Marked prints will be returned to Contractor for use in preparing Record Drawings.

C. Prior to the issuance of a certificate for final payment, submit to Architect and obtain his approval of the following:
1. Record drawings – plumbing piping (PDF reproducibles) and electronic files in AutoCAD.
2. Equipment Submittal Data (2).
3. Equipment operating and maintenance manuals (2).
4. Equipment warranty dates and guarantees (2).
5. Pressure vessel certificates (2).
6. Certificate of Disinfection of domestic water lines.
7. List of Owner's Personnel who have received operating and maintenance instructions.
8. Submit factory start-up/field reports for:
    a. Domestic water heaters.
    b. Domestic hot water recirculating pumps

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 22 0401

SECTION 22 0403

BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Description of common piping, equipment, materials and installation for Plumbing systems.

B. This Section includes the following:
1. Piping materials and installation instructions common to most Plumbing piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Concrete.
7. Grout.
8. Escutcheons.
9. Access doors - Building.
10. Flashing
11. Workmanship.
12. Cutting and patching.
13. Excavation, trenching and backfilling.
14. Piping systems installation - Common Requirements.
15. Equipment installation - Common Requirements.
16. Painting and finishing.
17. Concrete bases.
18. Supports and anchorages.
19. Protection and cleaning of equipment and materials.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:
1. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1.3 SUBMITTALS

A. Product Data: For the following:
   1. Transition fittings.
   2. Dielectric fittings.
   3. Mechanical sleeve seals.
   4. Escutcheons.
   5. Access doors - building.

1.4 INFORMATIONAL SUBMITTALS

A. Shop Drawings: For multi-story buildings, submit detailed drawings of the floor penetration sleeve sizes and locations, including the following information:
   1. Fully dimensioned off column lines with location respective to adjacent walls shown.
   2. Sleeve size.
   3. Pipe size and insulation thickness.
   4. Pipe service.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture. If pipes do not ship with end caps, cover ends of pipe stored on site with 6 mil plastic.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for Plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves and inserts in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate installation of building access doors for Plumbing items requiring access that are concealed behind finished surfaces.

D. Electrical Characteristics for Plumbing Equipment:
   1. Coordinate electrical system installation to match requirements of equipment furnished on this project.
   2. If minimum energy ratings or efficiencies are specified, equipment shall comply with these requirements.
   3. Include a letter with the respective equipment submittal from the electrical contractor and approved by electrical design consultant, detailing changes to the electrical system required to accommodate changes in the power distribution system to accommodate Plumbing equipment that has different electrical power requirements from that equipment used as basis of design, or power provisions, as shown on the electrical drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:

2.2 PIPE, TUBE AND FITTINGS

A. Refer to individual Division 22 Plumbing Piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 Plumbing Piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

G. Press Fit: EPDM O-rings meeting performance criteria of IAPMO PS 117.

H. Composite Automatic Couplers (Transair®) ISO 4414

2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:
   1. For pipe sizes NPS 2 and smaller: PVC or CPVC, Schedule 80, one-piece fitting; one end with threaded brass insert, and one solvent-cement socket or threaded end.
   2. For pipe sizes larger than NPS 2: Flanged joints.

B. Fitting-Type Transition Couplings:
   1. Manufactured piping coupling or specified piping system fitting.

2.5 DIELECTRIC FITTINGS

A. Dielectric Nipples:
   1. Manufacturers:
      a. Perfection Corp.
      b. Precision Plumbing Products, Inc.
      c. Sioux Chief Manufacturing Co., Inc.
      d. Victaulic Co. of America; Clearflow Dielectric Waterway Style 47.

   2. Zinc electroplated steel nipple with inert and noncorrosive, thermoplastic lining; treaded ends; and 300 psig minimum working pressure at 230 deg F. Ring-groove to lock liner to steel casing and provide indentifying roll marking.

B. Dielectric Flanges:
   1. Manufacturers:
      a. Capital Manufacturing.
      b. Central Plastics.
      c. Watts.
      d. Wilkins, a Zurn Company.
   2. Standard: ASSE 1079.
   3. Factory-fabricated, bolted, companion-flange assembly.
   4. End Connections: Solder-joint or thread copper alloy and thread ferrous.
   5. Dielectric Flange Insulating Kits:
      a. Non-conducting materials for field assembly or companion flanges.
      b. Gasket: Neoprene or phenolic.
      c. Bolt Sleeves: Phenolic or polyethylene.
      d. Washers: Phenolic with steel backing washers.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
   1. Available Manufacturers:
      a. Calpico, Inc.
      b. Innerlynx, Advance Products & Systems, Inc.
      c. Link-Seal by Thunderline.
      d. Metraflex Co.
      e. Pipeline Seal and Insulator, Inc.
   2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   3. Pressure Plates: Plastic. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.
   5. Provide high temperature and U.L. fire rating at fire rated wall penetrations.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 20 gauge minimum thickness; round tube closed with longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Firestopping Sealant: See Division 07 Sections “Through-Penetration Firestop Systems” and “Fire Resistive Joint Systems” for firestopping sealant requirements.

D. Stuffing Insulation: Glass fiber type, non-combustible.

E. PVC Pipe: ASTM D2665 and ASTM D1785, Schedule 40.
   1. For PEX tubing passing through walls only.

2.8 CONCRETE

A. Nominal weight concrete (145 PCF) using Type I Portland Cement, 1-inch maximum size coarse aggregate to provide a minimum 28 day compressive strength of 3000 psi.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
   1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.10 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
1. Finish: Polished chrome-plated.

2.11 ACCESS DOORS – BUILDING

A. Manufacturers:
1. Bilco.
2. Milcor.
3. Nystrom.

B. Construction:
1. Door: 14-gauge, cold rolled steel.
2. Frame: 16-gauge, cold rolled steel of configuration to suit material application.
3. Hinge: Concealed spring hinge.
4. Latch: Screwdriver cam latch.
5. Finish: Phosphate dipped and prime coated.
6. UL labeled when in fire-rated construction with rating to match construction.
7. Stainless steel (Type 304) shall be used in ceramic tile or glazed structural tile.

C. Size: 16 inch x 16 inch minimum, as indicated on drawings, or as required to allow inspection, service, and removal of concealed items.

2.12 FLASHING

A. Flexible Flashing: 47 mil thick sheet butyl compatible with roofing.

B. Lead Flashing: Waterproofing, 5 lb/SF sheet lead.

C. Pitch Cups: 20 gauge galvanized steel, minimum 8 inches deep, bases mitered and soldered and extending at least 4 inches horizontally.

D. Shower Pans: Specified in Division 09, Section “Ceramic Tile.”

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. First class and in accordance with best practice. Work to be orderly, neat, workmanlike in appearance and performed by skilled craftsman.

B. Poor or improper workmanship shall be removed and replaced as directed by the Architect without additional cost to the Owner or design professionals.

3.2 CUTTING AND PATCHING

A. Comply with the requirements of other Divisions for the cutting and patching required to accommodate the installation of Plumbing work. Repair and finish to match surrounding.

B. Architect’s approval required before cutting any part where strength or appearance of finished work is involved.

C. Openings are to be laid out and built-in, set sleeves and inserts and furnish detailed layout drawings to other trades in advance of their work.
1. See Part 1 – 1.4 Informational Submittals above.

D. Core drill or saw cut openings in existing masonry construction.

3.3 EXCAVATION, TRENCHING AND BACKFILLING

A. Provide trenching, excavation, backfilling necessary for performance of work, including excavation of rock and all other materials which may be encountered.

B. Grade bottom of trenches evenly and excavate bell holes to insure uniform bearing for the full pipe length. Excavate minimum 6 inches below pipe. Refill cuts below grade with sand.

C. Backfill after inspection by Architect and authorities having jurisdiction. Backfill compacted areas (engineered fill) with sand or fine gravel in accordance with requirements in Division 31. Section “Earthwork” no less than 95% compactancy. Backfill paved areas with sand or fine gravel compacted to meet requirements of Paving Section. Backfill shall be free of rock, wood, steel, brick, etc. Do not disturb pipe.

D. Refer to Division 22, Plumbing Piping Sections for specific bedding and backfill requirements.
   1. For factory or field insulation or coated piping, the bedding shall be a minimum of 6 inches of sand. The first 12 inches of backfill above the pipe shall be sand.

E. Restore existing pavement, curbs, sidewalks, sodding, bushes, etc., matching surroundings.

F. Restore all pavement cuts to meet the requirements of the cuts of the local authority.

3.4 PIPING SYSTEMS INSTALLATION - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Plumbing Sections specifying piping systems.

B. Drawings, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and in service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections. No mitering or notching for fittings permitted.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons where exposed, non-insulated piping penetrates walls, ceilings, and floors in finished spaces.

M. Connections to compressed air mains shall be made to the top of the main.

3.5 SLEEVES

A. Sleeves are not required for core-drilled holes, or wall hydrants.

1. In mechanical room floors and other potentially wet areas, provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
   1. Cut sleeves to length so that sleeve extends out ½ inch from both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas, or other potentially wet areas, 1-1/2 inches above finished floor level. Caulk space outside of sleeves water tight.
   2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
   3. Use the following sleeve materials:
      a. Sleeves for Piping Through Concrete Beams, Concrete Walls, Footings, and Potentially Wet Floors: Steel pipe.
      b. Sleeves for Piping Through Masonry Walls and Gypsum Board Partitions: Steel sheet sleeves 1/2 inch larger than pipe or pipe covering.
   4. Where piping penetrates non-rated equipment room wall, floors or roofs outside of a shaft, close off space between pipe or duct and adjacent work with stuffing insulation and caulk air tight.
   5. Above ground, non-rated, exterior wall penetrations: Seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
   6. Provide for continuous insulation wrapping thru sleeve.
   7. Seal space around the outside of sleeves with grout at masonry walls and floors and dry wall mud at gypsum board partitions.

C. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

D. Fire-Rated Penetrations: Where pipes pass through fire-rated and fire-resistive floors, walls, and partitions, install appropriately rated sleeves and firestopping sealant. Firestopping materials and installation methods are specified in Division 07 Sections “Through Penetration Firestop Systems” and “Fire Resistive Joint Systems”.

E. Cast in Place Sleeving System Installation:
   1. General: Install penetration firestopping to comply with manufacturer’s published installation instructions and drawings for products and applications indicated.
   2. Install forming materials and other accessories of types required to support fill materials during application in the position needed to produce cross-sectional shapes and depths required for the fire ratings required:
      a. After installing fill materials and allowing them to fully cure, remove combustible forming materials and accessories not indicated as permanent components of firestopping.

3.6 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Plumbing Piping Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

G. Flanged Joints:
1. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.
2. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.

I. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

J. Composite automatic couplers:
1. Composite automatic couplers shall be installed in accordance with manufacturers installation instructions.

K. Press Fit:
1. Copper press connections shall be made in accordance with manufacturers installation instructions.
2. Copper tubing shall be fully inserted into the fitting and checked.
3. The joints shall be pressed using tools approved by the manufacturer.
4. Joints shall meet performance criteria of IAPMO PS 117. Fittings shall conform to ASME 16.22.

3.7 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Wet Piping Systems: Install dielectric fittings to connect piping materials of dissimilar metals.

3.8 PIPE CLEANING

A. Keep pipe clean and free of dirt. Keep caps on ends of pipe when it is stored on site and reinstall caps on ends of installed piping at the end of each day.

3.9 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

D. Install equipment in accordance with manufacturer's instructions. If manufacturer's instructions conflict with Contract Documents, obtain Architect's decision before proceeding.

E. Install equipment to allow right of way for piping installed at a required slope.

F. All equipment shall be firmly fastened in place:
   1. Pad mounted equipment shall be secured to pads using poured in place anchor bolts or cinch anchors.
   2. Vibration isolators shall be secured to floors or pads and equipment shall be bolted to the isolators.

G. All back-to-back floor mounted water closets shall be connected via a double combination wye and 1/8 bend. Sanitary crosses are **NOT** acceptable.

3.10 PAINTING AND FINISHING

A. Except as specified below or noted on the Drawing, requirements for painting of Plumbing systems, equipment, and components are specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Paint water pipe and insulation downstream of backflow preventor (non-potable water) to termination point, or to connection with mechanical system piping, purple.

3.11 CONCRETE BASES

A. Provide concrete foundations with nominal dimensions conforming to the following schedule for floor-mounted equipment:

Equipment	Foundation
Domestic water heaters	4" high pad
Equipment and piping stands and supports	4" high pad

B. Concrete bases shall be continuous and shall have beveled edges and smooth float finish. Concrete bases shall be reinforced with No. 3 bars a maximum of 12" on center each way, and held in place with dowel rods at each corner anchored in the slab. Dowel rods shall not penetrate through the slab.

C. Roughen and clean exposed slabs before pouring foundations. Apply bonding agent to surfaces in contact.

D. Concrete pads shall extend a minimum of 4" beyond the equipment footprint in all directions, including appurtenances, vibration isolators, base elbow supports, and motors.

E. Equipment attached directly to foundations or inertia bases; bases provided with grout holes; and bases consisting of a structural frame shall have voids filled with grout after attachment to foundation.

F. Fill voids between baseplates and foundations, and level equipment, with grout.

3.12 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" requirements.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.13 GROUTING

A. Mix and install grout for Plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.14 ACCESS DOORS – BUILDING

A. Provide access doors in wall and inaccessible ceilings to allow access to service and maintain concealed Plumbing equipment, valves, etc.

B. Coordinate installation of access doors with Divisions responsible for Building System in which panels are being installed.

3.15 FLASHING

A. Provide flexible flashing and metal counterflashing where pitch cups and piping penetrate weather or waterproofed walls, floors and roofs.

3.16 PROTECTION AND CLEANING OF EQUIPMENT, FIXTURES, AND MATERIALS

A. Equipment, fixtures, and materials shall be carefully handled, properly stored, and protected from weather, dust-producing procedures, or damage during construction.

B. At completion of all work, thoroughly clean, exposed materials (pipe, etc.), equipment, and fixtures and make ready for painting.

END SECTION 22 0403

SECTION 22 0405

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, including color and letter style.

1.3 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, “Scheme for the Identification of Piping Systems,” for letter size, length of color field, colors, and viewing angles of identification devices for piping, unless otherwise noted herein.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16-inch thick, and having predrilled holes for attachment hardware.
2. Color Coding:

System	Background Color	Letters
Equipment served by emergency power	Red	White
Other equipment	Black	White

3. Temperatures up to 160 deg F.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4-inch.
5. Minimum Letter Size: Minimum ½-inch high. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless-steel self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16-inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4-inch.

F. Minimum Letter Size: Minimum 1/2-inch high for viewing distances up to 72-inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information as indicated elsewhere in the Specifications and on the Drawings.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
   1. Colors: Comply with ASME A13.1, unless otherwise indicated.
   2. Lettering: Use piping system terms indicated on the Drawings. Abbreviate only as necessary for each application length.

B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to partially cover circumference of pipe on lines 6-inches outside diameter, including insulation, and smaller; Snap on, on lines over 6-inches outside diameter, including insulation, and secure with nylon straps.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on the Drawings and an arrow(s) indicating flow direction.
   1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions; or as a separate unit on each pipe label to indicate flow direction.
   2. Lettering Size: At least 1-1/4-inches high for 2-1/2-inch and larger pipe outside diameter, including insulation.

D. Following existing labeling color and format in existing buildings, unless otherwise directed by the Architect.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of Plumbing equipment.

B. Install or permanently fasten labels on starters furnished under this Division.

C. Locate equipment labels where accessible and visible.

3.3 WARNING-SIGNS AND LABELS INSTALLATION

A. Write required message on, and attach warning tags to equipment and other items where required in the specifications or shown on the Drawings.

3.4 PIPE LABEL INSTALLATION

A. Identify piping specified under this Division in accordance with ANSI/ASME A13.1.

B. Locate pipe labels where piping is exposed, or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows: **(Note: In finished spaces, obtain direction from Architect prior to installing pipe labels.)**
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
   4. Near each change in direction.
   5. At access doors, manholes, and similar access points that permit view of concealed piping.
   6. Near major equipment items and other points of origination and termination.
   7. Spaced at maximum intervals of 20 feet along each run.

C. Pipe Label Color Schedule:

Piping System	Background Color	Letter Color
Domestic Cold-Water	Green	White
Domestic Hot-Water Piping	Green	White
Domestic Hot-Water Return Piping	Green	White
Non-Potable Water	Purple	White
Soil	Green	White
Waste	Green	White
Vent	Green	White

END OF SECTION 22 0405

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SECTION 22 0407

PLUMBING SYSTEMS INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

1.2 RELATED SECTIONS

A. Division 07 – Firestopping.

B. Division 22 – Section 220405 “Identification for Plumbing Piping and Equipment.”

C. Division 22 – Section 220410 “Plumbing Piping”: Placement of hangers and hanger inserts.

1.3 SUBMITTALS FOR REVIEW

A. Section 220401: Procedures for submittals.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing insulation work with minimum 3 years’ experience.

1.5 REGULATORY REQUIREMENTS

A. Conform to maximum flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255 or UL 723.

B. All insulation materials, adhesives, mastic and coating shall be asbestos free.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufactures for Fiberglass Insulation Materials:
1. Owens-Corning.
2. Certainteed.
3. Knauf.
4. Johns Manville Corporation

B. Acceptable Manufacturers for Adhesives, Mastics and Coatings:
1. Armstrong.
2. Benjamin Foster.
3. Childers.
4. Marathon.

2.2 GLASS FIBER PIPE INSULATION

A. Manufacturer: Owens-Corning Model SSL-11.

B. Insulation: ASTM C547; rigid molded, noncombustible.
1. ‘K’ value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum service temperature: 850 degrees F.
3. Maximum moisture absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket:

1. White kraft paper with glass fiber yarn, bonded to aluminized film.
2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.

D. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive:
1. Compatible with insulation.

F. Insulating Cement/Mastic:
1. ASTM C195; hydraulic setting on mineral wool.

2.3 JACKETS – PIPING AND EQUIPMENT

A. Canvas Jacket: UL Listed.
1. Fabric: ASTM C921, 6 oz/sq yd plain weave cotton treated with dilute fire retardant lagging adhesive.
2. Lagging Adhesive: Compatible with insulation.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and jacketed outdoor use on below ambient services.
1. Products:
   a. Childers Products, Division of ITW; CP-35.
   b. Foster Products Corporation, H.B. Fuller Company; 30-90.
   c. ITW TACC, Division of Illinois Tool Works; CB-50.
   d. Marathon Industries, Inc.; 590.
   e. Mon-Eco Industries, Inc.; 55-40.
   f. Vimasco Corporation; 749.
2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping and equipment have been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with NAIMA National Insulation Standards.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

D. Fit pipe hangers over insulation.

E. Inserts and Shields:
1. Application: Protect insulated piping at hangers and supports with insulation shield. On pipe sizes over 2 inches, provide insert.

2. Insulation Protection Shield: Galvanized steel formed in half circle to fit insulation. Length and gauge as follows:
   a. Up to NPS 4: 12 inches long and 22 gauge.
   b. NPS 6: 18 inches long and 22 gauge.
   c. NPS 8 through 12: 24 inches long and 18 gauge.
   d. NPS 14 and Large: 24 inches long and 16 gauge.
3. Insulation-Insert Material: Water repellent treated, ASTM C533, Type I calcium silicate; or ASTM C552, Type II cellular glass of same thickness and vapor barrier jacket specified for surrounding insulation. Insert shall be a minimum of 2 inches longer than the shield.
4. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
5. For Clevis Hangers: Insert shall cover lower 180 degrees of pipe.
6. Option: At Contractor's option, insert may be factory fabricated Thermal Hanger Shield (insulation insert encased in sheet metal shield) equal to Pipe Shield, Inc. "Insulated Pipe Supports."
7. Option: At Contractor's option, steel pipe saddles may be used on hot water pipe in lieu of insert and shield. Fill interior void of saddle with insulation that matches adjoining insulation.

F. Continue insulation through metal studs, walls, sleeves, pipe hangers, and other pipe penetrations. Finish firestopping at supports, protrusions, and interruptions. At fire separations, refer to Division 07 and Section 220410: Sleeves.

G. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.3 GLASS FIBER PIPE INSULATION APPLICATION

A. Provide vapor barrier jackets, factory or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding stapes 4 inch on center and vapor barrier mastic.

B. Insulate fittings, joints and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

C. **Finish fittings exposed in equipment rooms, boiler rooms and in finished spaces with vinyl acrylic mastic over glass fab**.

D. For hot piping do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

3.4 SCHEDULES - PIPING

A. Plumbing Piping:
1. Domestic Cold Water Interior, Above Grade:
   a. Glass Fiber Pipe Insulation
      1) All pipe sizes: 1 inch thick.
      2) Pipes located in walls: ½ inch thick.
2. Domestic Hot and Recirculating Water Interior, Above Grade:
   a. Glass Fiber Pipe Insulation
      1) All pipe sizes: 1 inch thick.
      2) Pipe located in walls: ½ inch thick.

3.5 INSTALLATION – EQUIPMENT INSULATION GENERAL

A. Install in accordance with NAIMA Insulation Standards.

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires or bands.

E. Fill joints, cracks, seams and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

F. Insulated equipment containing fluids below ambient temperature: Insulate entire system.

G. Finish insulation at supports, protrusions, and interruptions.

H. Equipment in Mechanical Rooms or Finished Spaces: Finish with canvas jacket or as scheduled.

I. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

J. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

END OF SECTION 22 0407

SECTION 22 0410

PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, valves for the following piping systems:
   1. Sanitary, waste and vent piping.
   2. Domestic, hot and cold water piping.

1.2 RELATED SECTIONS

A. Section 220401 – General Plumbing Requirements.

B. Section 220403 – Basic Plumbing Materials and Methods.

C. Section 220405 – Identification for Plumbing Piping and Equipment.

D. Section 220407 – Plumbing Systems Insulation.

1.3 SUBMITTALS FOR REVIEW

A. Division 01 – Submittals and Section 220401: Procedures for submittals.

B. Provide product data on the following:
   1. Pipe materials, pipe fittings and accessories.
   2. Manufacturers catalogue data and cut sheets on all fixtures and equipment.
   3. Valve data and ratings.

C. Manufacturer's drawings of listed closing methods to be used to close penetrations through rated assemblies.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with the City of Tuscaloosa, Alabama, codes and standards.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

PART 2 - PRODUCTS

2.1 SANITARY WASTE PIPING, BELOW GRADE OR BELOW SLAB ON GRADE

A. PVC Pipe:
   1. Pipe: Schedule 40, ASTM D2665 and ASTM D1785.
   2. Fittings: PVC with DWV pattern, ASTM D2665.
   3. Joints: ASTM D2855, solvent weld with ASTM F-656 purple primer and ASTM D2564 solvent cement.

2.2 SANITARY WASTE AND VENT PIPING, ABOVE SLAB ON GRADE

A. Cast Iron Pipe:
   1. Pipe: CISPI 301, hubless, service weight, bituminous coating.
   2. Fittings: Cast iron, bituminous coated.
   3. Joints: CISPI 310, neoprene gaskets and stainless steel clamp and shield assemblies. All standard duty hubless couplings shall meet CISPI 310 and be listed by NSF International.
      a. Approved manufacturers: Husky HD 2000, Mission Heavyweight or Clamp All-80.
      b. Approved manufacturers: Anaco Husky HD 4000, Ideal-Tridon Super Heavy Duty "HD" no-hub couplings, fernco HD Heavy Duty no-hub couplings.

2.3 WATER PIPING, BELOW SLAB ON GRADE OR BELOW GRADE

A. Copper Tubing:
   1. Pipe: ASTM B88, Type K soft copper.
   2. Fittings: ASME B16.22 wrought copper and bronze.
   3. Joints: "Sil-Fos".
   4. Piping to be installed to minimize the number of joints below grade of or below slab on grade.
   5. Encase all below ground copper piping in plastic sleeve or 1/2" unsplit foam insulation.

2.4 WATER PIPING, ABOVE GRADE

A. Copper Tubing:
   1. Pipe: ASTM B88, Type L, hard drawn.
   2. Fittings: ASME B16.22, wrought copper and bronze.
   3. Joints: ASTM B32, 95-5 solder, Grade 95TA, lead free with lead free flux.

B. Insulation:
   1. Insulate all water piping (cold, hot and hot return) above slab on grade with 1" fiberglass insulation. Insulation thickness may be reduced to 1/2 inch walls. Foam type insulation may be used in concrete block walls.
   2. Insulation shall be installed continuous through walls.
   3. See Section 220407 of the specifications for insulation description.

C. Identification:
   1. Identify all piping in accordance with Section 220405 of the specification.

2.5 FLEXIBLE PIPE CONNECTIONS

A. Stainless steel corrugated tubing with stainless steel wire braid.

B. Working pressure 200 psi minimum.

C. End connections 2” and smaller-male pipe threads, larger than 2” flanged.

D. Manufacturers: Minnesota Flexible Corporation, Metaflex, Flexicraft and Hyspan.

2.6 FLANGES, UNIONS, AND COUPLINGS

A. Pipe Size 2 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Pipe Size Over 2 Inches:
   1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Dielectric Connections: Dielectric waterway; zinc electroplated steel nipple with thermoplastic liner and threaded ends.

2.7 PIPE HANGERS AND SUPPORTS

A. Hangers:
   1. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Carbon steel, adjustable swivel, split ring.
   2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods or Unistrut multiuse channel.
   4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

5. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
6. Vertical Support: Steel riser clamp.
7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
8. Copper Pipe Support when applied directly to the copper piping: Copper steel ring, adjustable.
9. Install hanger over insulation on insulated pipe with sheet metal saddle rolled on the ends centered in hanger. See Section 220407.

B. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

C. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

D. Roof Supports:
1. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Erico PP50H6.
2. Hangers for Pipe Sizes 2 Inches and Over: Erico PP50H6.
3. Vertical Support: Steel riser clamp.

E. For fasteners in existing concrete structures, use drilled in expansion anchors with load rating 150% greater than the pipe hanger rating. Note: Powder drive anchors are not acceptable.

F. Beam Clamps: Grinnell Figure #229.

2.8 BALL VALVES (LEAD FREE)

A. Up to and including 4 inches:
1. Manufacturers:
a. Jomar JF-100SG / JF-100TG full port.
b. Nibco, Apollo, Milwaukee, Kitz 868M/869M (3/8”-2”).
2. MSS-SP-110 Class 125, lead free bronze body, 316 stainless steel full port ball and stem, PTFE seats and seals, blow-out proof stem and threaded ends.

2.9 BUTTERFLY VALVES (LEAD FREE)

A. For pipe sizes 4 inches and larger
1. Manufacturers
a. Kitz 6133EL
b. Nibco, Jomar, Watts, Apollo, Milwaukee
2. Ductile iron body, lug style, stainless steel disc and stem, 10 position handle, EPDM o-rings
3. 250 PSI
4. Conforms to NSF 61, MSS-SP-67

2.10 BALANCING VALVES (CIRCUIT SETTER)

A. Manufacturer:
1. Caleffi 142251A Series, 3/4-inch variable orifice balancing valve.

B. Install on hot water return line at point of connection to hot water return riser on main and where indicated on drawings. Provide ball valve on leaving side of flow indicator.

2.11 SWING CHECK VALVES (LEAD FREE)

A. Up to and Including 3 Inches:
1. Manufactures:
a. Nibco Model S-413-Y-LF or T-413-B-LF.
b. Crane, Stockham, Milwaukee, Kitz.

2. MSS SP-80 and MSS SP-139, Class 125, bronze body and cap, bronze trim and seat, threaded ends.

2.12 WATER PRESSURE REDUCING VALVES

A. Provide water pressure reducing valve at the service entry on all buildings where main pressure is in excess of 80 psi. Set out pressure at 70 psi.

B. Up to and Including 2 Inches:
   1. Manufactures:
      a. Watts Model U5B.
      b. Wilkins, Cash, Acme.
   2. MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, internal by-pass, inlet strainer, threaded ends with single union and ball valve upstream of strainer.

C. Over 2 Inches:
   1. Manufactures:
      a. Watts ACV 115.
      b. Williams, Cash, Acme.
   2. MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

D. Provide pressure gage (0-150 PSI) with needle valve stop on leaving side of pressure reducing valve

2.13 THERMOMETERS

A. Lights actuated digital thermometer reading in degrees Fahrenheit. Provide with well for minimum 1" insulation.

B. Weiss Vari-angle Digital Thermometer.

2.14 PRESSURE GAUGE (DOMESTIC WATER)

A. Manufacturers:
   1. Trerice.
   2. Weiss.
   3. Weksler.
   4. Winters.

B. 4-1/2-inch diameter, minimum dial face, stamped stainless steel, replaceable glass lens, with snap-on rings. Phosphor bronze tube, bronze brushed rotary movement, silver brazed or soldered to brass socket and brass tip, 1/4-inch bottom connection. Accuracy, on (1.0) percent of included scale range. White dial face with black numerals, graduated in pounds; equipped with bronze pulsation dampener or snubber and needle valve.

2.15 SLEEVES

A. Refer to Division 22, Section "Basic Plumbing Materials and Methods" for requirements.

2.16 FIRE STOP SYSTEM

A. All wall and floor penetrations are to be closed. Refer to the Arch. Life Safety Plans and close all openings with a U.L. Listed assembly compatible with the rating of the wall or floor being penetrated.

B. Non-rated walls:
   1. Sheet rock joint compound may be used to seal opening. Insulation to be continuous through wall.

C. For piping passing through sheet rock walls or partitions:

1. Insulated pipe passing through 2 walls or partitions – Hilti FS605 with sleeve U.L. Listing #WL1056.
2. Insulated pipe passing through 2 hour walls or partitions – Hilti FS611A with no sleeve, U.L. Listing #WL5029. Insulation to be continuous through sleeve.

D. For piping passing through concrete floors, concrete walls or concrete block walls:
1. Uninsulated Schedule 40 steel on copper pipe: Hilti #F5605 with sleeve, U.L. #CAT155.
2. Insulated Schedule 40 steel on insulated copper pipe: Hilti #FS6114A, U.L. #CAT5045.

E. For non-metallic piping passing through concrete floors, walls or concrete block.
1. 2” and smaller piping: Hilti #FS611A, U.L. #CAT2062 or U.L. #CAT2065.
2. Larger than 2”: Hilti #FS611A with collar, U.L. #CAT095.

2.17 FLASHING

A. Refer to Division 22, Section “Basic Plumbing Materials and Methods” for requirements.

2.18 WATER HAMMER ARRESTERS

A. Install water piping to ASME B31.9. Closed copper tube chamber with permanently sealed 410 kPa (60 psig) air charge above a Double O-ring piston. Two high heat Buna-N O-rings pressure packed and lubricated with FDA approved silicone compound. All units shall be designed in accordance with ASSE 1010 for sealed wall installations without an access panel. Size and install in accordance with Manufacturers requirements. Unit shall be as manufactured by Precision Plumbing Products, Inc., Watts, or Sioux Chief. Provide water hammer arrestors at:
1. All solenoid valves.
2. All groups of two or more flush valves.
3. All quick opening or closing valves.
4. All washing equipment.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cut pipe square and ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Provide quarter turn, full port ball valve between all pressure gauges and piping system.

3.2 PIPING INSTALLATION GENERAL

A. Install in accordance with manufacturer’s instructions.

B. Provide dielectric fittings wherever jointing dissimilar metals.

C. Make piping connections to equipment with flanges or unions.

D. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

E. Run piping concealed, except where specifically shown to be exposed.

F. Install piping to maintain headroom, conserve space, and not interfere with use of space.

G. Group piping whenever practical at common elevations.

H. Install piping to allow for expansion and contraction without stressing pipe, joints or connected equipment.

I. Provide clearance in hanger and from structure and other equipment for installation of insulation and access to valves and fittings.

J. Provide access where valve is not accessible. Provide minimum 18”x18” access doors at valves in hard ceiling.

K. Establish elevations of buried pressure piping outside the building to ensure not less than 18 inches of cover.

L. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 099100.

N. Install chrome plated floor, wall and ceiling plates on all exposed piping passing through finished surfaces in finished spaces.

O. Install bell and spigot pipe with bell end upstream.

P. Install valves with stems upright or horizontal, not inverted.

Q. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, or in existing concrete structures use drilled in expansion anchors with load rating at least 150% of pipe hanger rating (powder driven anchors not acceptable).

R. Pipe Hangers and Supports:
1. Support horizontal piping as scheduled.
2. Install hangers to provide minimum ½-inch space between finished covering and adjacent work.
3. Place hangers within 12 inches of each horizontal elbow.
4. Use hangers with 1-1/2-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
6. Where several pipes can be installed in parallel and at same elevation, trapeze hangers may be used.
7. Provide copper hangers and supports when applied directly to copper piping.
8. Prime coat exposed steel hangers and supports located outdoors, in crawl spaces, pipe shafts. Above suspended ceiling spaces is not considered exposed.
9. Provide hangers adjacent to motor driven equipment.
10. Support cast iron drainage and vent piping at every joint and minimum 5'-0" on center.
11. Support of all pipe, tubing and fixtures and equipment shall be accomplished by means of engineered products specified to each application. Makeshift, field devised methods of plumbing pipe supports, such as scrap wood, wire or duct tape are not allowed. These shall be HoldRite, B-Line, Sioux Chief or approved equal.

S. Provide pipe line markers and valve tags in accordance with other sections of the specifications.

T. Sleeves:
1. Refer to Division 22, Section “Basic Plumbing Materials and Methods” for requirements.

U. Flashing:
1. Refer to Division 22, Section “Basic Plumbing Materials and Methods” for requirements.

3.3 EXCAVATION AND BACKFILLING

A. Refer to Division 22, Section “Basic Plumbing Materials and Methods” for requirements.

3.4 APPLICATION

A. Install unions at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system.

C. Install valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Provide check valves on discharge of water pumps.

E. Provide flow indicators in water recirculating systems where indicated.

3.5 ERECTION TOLERANCES

A. Slope all sanitary waste piping and storm piping at a minimum 1/8" per foot. Slope all sanitary sewer piping 2" and smaller below slab on grade at a minimum 1/4" per foot.

B. Arrange all water piping to drain to low points and provide ball valve with plug at low point.

3.6 SANITARY, WASTE AND VENT SYSTEM

A. Install vent stacks through roof. Terminate 12 inches above finish roof and minimum 10'-0" from HVAC roof top unit outside air intakes. Flashings for penetrations are under another section.

B. Connect to site sanitary sewer approximately 5'-0" from building. Verify exact size, location and invert with Civil Drawings prior to beginning work.

3.7 WATER PIPING SYSTEM

A. Connect to site water service approximately 5’-0" from building installed under another section. Verify with Civil drawings exact size and location of site water service.

3.8 FIELD QUALITY CONTROL

A. Perform all tests as required by local codes. Contractor shall furnish testing equipment and keep a record of all testing listing tests made, results and those witnessing test. Include testing record in close out documents.

B. If local codes are more stringent than the following, local codes shall govern.

C. Sanitary, Waste, Vent and Rain Water Systems:
   1. Test piping by stopping lower outlets and filling to 10 feet hydrostatic head for a minimum period of 15 minutes with all joints exposed throughout test. Stop all leaks and retest system until tight.
   2. Test all piping by stopping all outlets and applying 5 pounds per square inch of air pressure to the system for a period of 15 minutes. Stop all leaks and retest system until tight.
   3. Provide ball test on all piping 3" and larger.

D. Domestic Water Piping:
   1. Hydrostatic test at 150 psig without pressure drop for 4 hours. Stop all leaks and retest system until free from leaks.
   2. Leave City pressure on system for duration of project.

3.9 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify hot and cold water systems are complete, flushed and clean.

B. Ensure PH of water to be treated is between 7.4 and 7.6.

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 ppm residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 ppm, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water.

H. Submit sample of water from all new or modified systems to local Health Department and receive certification that water is acceptable for human consumption. Include certification of water in close out documents.

3.10 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe size: 1/2 to 1-1/4 inches:
         1) Maximum hanger spacing: 6.5 ft.
         2) Hanger rod diameter: 3/8 inch.
      b. Pipe size: 1-1/2 to 2 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 3/8 inch.
      c. Pipe size: 2-1/2 to 3 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 1/2 inch.
      d. Pipe size: 4 to 6 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 5/8 inch.
      e. Pipe size: 8 to 12 inches:
         1) Maximum hanger spacing: 14 ft.
         2) Hanger rod diameter: 7/8 inch.
      f. Pipe size: 14 inches and over:
         1) Maximum hanger spacing: 20 ft.
         2) Hanger rod diameter: 1 inch.
   2. Plastic Non-Metallic Piping:
      a. All Sizes:
         1) Maximum hanger spacing: 4 ft.
         2) Hanger rod diameter: 3/8 inch.

END OF SECTION 22 0410

SECTION 22 0440

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Plumbing fixtures.

B. Plumbing miscellaneous equipment.

1.2 RELATED SECTIONS

A. Section 220401 – Basic Plumbing Requirements.

B. Section 220403 – Basic Plumbing Materials and Methods.

C. Section 220405 – Identification for Plumbing Piping and Equipment.

D. Section 220407 – Plumbing Systems Insulation.

E. Section 220410 – Plumbing Piping.

1.3 SUBMITTALS FOR REVIEW

A. See Section 220401, Submittal for Review.

B. Plumbing Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, trim and finishes.

1.4 SUBMITTALS AT PROJECT CLOSEOUT

A. Refer to Division 01 and Section 220401 – Submittals for Project Closeout.

B. Maintenance Data: Provide 3 sets of manufacturer's maintenance and parts listing including the manufacturers nearest sales and service representative. Include the sales representative's address and telephone number. Provide with the listing, a suggested maintenance schedule for all equipment along with warranty dates. Items are to be provided in three ring binders with tabs identifying different equipment types.

C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years' experience.

1.6 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE AND PROTECTION

A. Accept fixtures on site in factory packaging, inspect for damage and store.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.8 WARRANTY

A. See other sections of the specification for additional warranty information.

B. The Contractor shall warrant all materials, workmanship and equipment for a period of one year from the date of substantial completion. Any defect in equipment or workmanship shall be made known to the Contractor within 1 year. Such deficiencies shall be corrected by the Contractor at no cost to the Owner.

1.9 EXTRA MATERIALS

A. See other sections of the specification for additional extra material requirements.

B. Provide two sets of cartridges or washers for all faucet types, two flush valve repair kits for all flush valve type and one loose key for each hose bibb or wall hydrant.

PART 2 - PRODUCTS

2.1 DRAINS

A. Mechanical Room Floor Drains (MFD): Mifab #1340-5 with sediment bucket. Provide deep seal trap, trap guard and coordinate exact location with HVAC equipment. Insulate suspended drain body and all horizontal piping serving mechanical floor drain until piping turns vertical.

B. Floor Drain (FD) and Shower Drain (SD): Mifab 1100-C-1 with 6" nickel bronze reinforced grate. Provide trap guard on floor drains and deep seal trap.

C. Hub Drain (HD): Open pipe with Jay R. Smith 3951 or 3955 fixed air gap fitting.

D. Trap Guard (TG): J.R. Smith #2692 quad close “stink stopper” trap seal device.

2.2 WALL HYDRANT

A. J.R. Smith #5519 ASSE 1052 listed wall hydrant, with integral backflow preventer, latching cover, freeze-proof and all bronze box. Provide casing of sufficient length in order that valve seat be on building side of exterior wall insulation. Install with center line 24" above finish grade and provide Owner with one (1) loose key for each wall hydrant.

2.3 HOSE BIBB

A. HB-1 Finished areas (in wall): J.R. Smith #5618 narrow wall hydrant, all bronze with integral vacuum breaker, and loose key.

B. HB-2 Un-Finished areas: Chicago Faucet #998 rough chrome plated brass with, drain plug, tee handle and vacuum breaker. Install with center line 24” above finished floor.

2.4 CLEANOUTS

A. Furnish and install cleanouts where indicated on drawings and at all 90-degree bends, angle, upper terminals and not over 75 feet apart on straight runs. All cleanouts on cast iron piping to have bronze countersunk tapered slotted plugs, except PVC piping cleanouts, which shall be standard of piping system used. Flush-with-floor cleanout access covers shall have non-skid covers. All wall cleanout access covers shall have polished satin finish. All cleanouts shall be full size of pipe, piping larger than 6" shall have minimum 6" cleanout covers.

B. Exposed Cleanouts: Cast brass plug type, J.R. Smith #4470.

C. Wall type cleanout plug and access covers, J.R. Smith #4472. Cleanout plug must be within 1" of finish wall and must be tapped for access cover. On PVC plastic waste pipe in wall; cleanout access cover J.R. Smith 4710.

D. Install wall cleanouts on stacks at flush valve fixtures 12" above top of flush value, 12” above top of flush tanks, 12" above finish floor on sinks, lavatories and water coolers and 12" above grab bars at fixtures with grab bars. Locate cleanouts to clear baseboard at floor.

E. Floor type cleanout access covers: J.R. Smith #4248-NB. Plug must be within 3" of finished floor. Provide J.R. Smith #4188 where installed in terrazzo floors and J.R. Smith #4168 where located in floor with asphalt or vinyl tile covering. Grout cleanout below access cover to seal watertight. Provide option "Y" cleanout carpet markers where installed in carpeted floors.

F. Outside Cleanouts: J.R. Smith #4258 cleanout access encased in a 18" X 18" X 6" deep concrete pad. See Detail on Drawings.

2.5 PLUMBING FIXTURES AND EQUIPMENT

A. Unless otherwise specified, all fixtures complete as catalogued, commercial grade, white color, exposed metal trim chromium plated.

B. Fixtures and brass shall be securely anchored. Carriers shall be securely anchored to floor with lug bolts in all holes as recommended by the manufacturer.

C. Flush valve "YJ" supports shall be installed 1 inch below vacuum breaker on all water closet flush valves and around vacuum breaker on urinal flush valves. Handles on A.D.A. water closets to be installed on wide side of room or stall.

D. Seal wall hung fixtures at wall with white silicone sealant. Seal countertop fixtures with clear silicone sealant.

E. Seal floor mounted water closets to floor with white silicone sealant.

F. Mount all fixtures at standard mounting height unless otherwise noted.

G. All faucets to be furnished with ceramic discs.

H. Furnish sinks and lavatories with correct number of drillings required for the faucet and accessories. Hole covers are not acceptable.

I. All similar products shall be by the same manufacturer.

J. All fixtures noted to be A.D.A. approved must be set with great care to assure proper mounting height and proper distance from wall.

K. All items complete as catalogued as follows:

WC-1 Water Closet:	Floor Mounted – Kohler K-96057 complete, Sloan G2 111-1.6GPF hardwire flush valve with YJ bracket and Church “Dura-Guard” model #2155SSCT seat.
WC-2 Water Closet: (ADA)	Floor Mounted – Kohler K-96057 complete, Sloan G2 111-1.6GPF hardwire flush valve with YJ bracket and Church “Dura-Guard” model #2155SSCT seat. Must meet ADA.
UR-1 Urinal:	Wall Hung – Kohler K-5016-ET complete, Sloan ECOS 186-0.5GPF hardwire flush valve with YJ Bracket, JR Smith #637 fixture support.
LAV-1 Lavatory:	Undermount bowl is integral to casework – T&S Brass 2867-04-LAM faucet, McGuire 155A outlet with tailpiece, McGuire 165 stops with supplies and McGuire 8872C P-Trap. Insulate P-trap, stops and supplies with

	McGuire ProWrap insulator kit. Provide TMV-1 with wall bracket installed below bowl. Must meet A.D.A.
EWC-1 Electric Water Cooler: (Bi-Level, ADA with Bottle Filling)	Elkay #EZSTL8WSLK bi-level water cooler with sensor activated bottle filling station with all stainless steel cabinet and waterways that are manufactured of 100% lead free material, J.R. Smith #834 fixture support, McGuire 8912C P-Trap and McGuire 165 stop with supply. Fully insulate P-Trap with McGuire ProWrap insulator. Install with lower spout outlet maximum 36" AFF. Must meet A.D.A.
JC-1 Janitors Receptor:	Stern Williams #HL-1800 (24" X 24") complete, T-35 hose with wall hook, stainless steel backsplash and T&S Brass B-0665-BSTR faucet with integral stops and spring checks.
SK-1 Sink:	Elkay LR2219, LK-35 strainer, Symmons S-6710-PD-1.5 faucet, McGuire 8912C P-Trap and McGuire 165 stops with supplies.
SK-2 Sink:	Elkay LRAD221955, LK-35 Strainer, T&S Brass B-2865 faucet, McGuire 8912C P-trap and McGuire 165 stops with supplies.
TMV-1 Thermostatic Mixing Valve:	Leonard Model 170D-LF Thermostatic mixing valve, installed in the “H” position with bracket secured to wall under all public and ADA lavatories. Valve must meet the minimum flow rate of .25 gpm. Set hot water temperature at 109 deg F and pipe as detailed on drawings. Must meet ASSE 1070.
BT-1 Bathtub:	Kohler K-20201 bathtub – white, acrylic w/ K-7272 PVC slotted overflow bath drain. Delta T13H933 tub and shower system complete, balanced control valve with blade handle, hand held spray, slide bar, elevated vacuum breaker, and diverting tub fill. After installation is complete, valve shall be adjusted to maximum 110 deg F by a factory trained representative. Provide wood backing in wall for control valve and slide bar.
REF-1 Refrigerator:	Furnished and installed under another Section. Provide in wall behind refrigerator a Sioux Chief OxBox 696 with minirester, angle stop and 10 feet of 1/4" soft copper coiled in box for connection to Refrigerator Ice Maker.
CM-1 Coffee Maker:	Furnished and installed under another Section. Provide in wall above the countertop a

	Brasscraft KTCR19 1/4 turn angle ball stop, escutcheon plate and 10 feet of 1/4" soft copper for connection to coffee maker.
IM-1 Ice Maker:	Furnished and installed under another Section, rough and connect complete. Provide ball valve stop on supply and pipe waste(s) to floor sink. Provide Watts 9D on cold water supply if required by Local Codes. Pipe relief full size to floor sink.
WMB-1 Washing Machine:	Furnish and set in place under another Section. Rough and connect complete. Provide ball valve cut off on hot and cold water supply. Install above ceiling a line size RPZBP with strainer on inlet side of backflow preventer and shock arrestor PDI size "B" on the outlet side. Pipe backflow preventer waste thru factory made air gap down in wall to trench drain.
DW-1 Dishwasher:	Furnished and installed under another Section, rough and connect complete. Provide ball valve stop on supply with shock arrestor PDI size "A" on hot water piping above ceiling.
EWH-1 Electric Water Heater:	Lochinvar LET-40 DJK with a storage capacity of 40 gallons. Set with outlet temperature of 125 deg F. Provide P & T relieve valve and install as detailed on Drawings. 4.5KW, 208/1/60. Verify voltage with Electrical Section. Provide with Holdrite Quick Stand floor stand 40-S-30-U or Quick Stand wall mounted platform 50-SWHP-W.
ET-1 Expansion Tank:	Amtrol Therm - X-Trol #ST-5 expansion tank. Pre-charged, with all wetted internal parts being FDS approved. Isolation between water and air shall be by a Butyl Diaphragm. Provide with 5-year warranty.
RCP-1 Circulator Pump:	Grundfos Model UPS 15-35 SFC. All Bronze. Provide with aquastat controller. 1/12HP 115V/1PH

2.6 ACCEPTABLE MANUFACTURERS

A. Where Kohler is listed above, Toto, Zurn, Mansfield, or American Standard may be substituted.

B. Where Sloan is listed above, Delaney, Toto and Zurn may be substituted.

C. Where J. R. Smith is listed above, Josam, Zurn, Mifab, Watts, Jones Stephens or Wade may be substituted.

D. Where Elkay water coolers are mentioned above, Halsey Taylor, Oasis, Acorn, or Aqua may be substituted, only if water ways are constructed of totally lead free materials.

E. Where Elkay or Franke sink(s) are listed above, Just or Advance Tabco may be substituted.

F. Where Church is listed above, Bemis, Beneke, Centoco, Olsonite or Comfort Seats may be substituted.

G. Where T&S Brass is listed above, Chicago, Speakman, Kohler, Royal, Cambridge, Moen Commercial, or Zurn may be substituted, provided manufacturer can furnish all fixture brass specified.

H. Where Lochinvar tank type water heaters are listed, HTP, Bradford-White, Rheem, or A.O. Smith may be substituted.

I. Where Stern Williams is listed above, Acorn, Fiat, Mustee, or Florestone may be substituted.

J. Where McGuire is listed above for traps, supplies and stops, Kohler, Crane, Eljer, Zurn, Dearborn, or American Standard may be substituted.

K. Where J.R. Smith trap guards are listed above, ProSet and Sureseal may be substituted.

L. Where McGuire ProWrap is listed above, "Handi Lav-Guard" by Truebro, "Trap-Wrap" by Brocar Industries, Inc., Dearborn, or Plumberex may be substituted.

M. Where Amtrol is listed for expansion tanks, John Wood, Watts, ITT-Bell & Gossett, Elbi, or Armstrong may be substituted.

N. Where J.R. Smith is listed for wall hydrants; Woodford, Zurn, Josam, Watts, or Mifab may be substituted.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify all electrical characteristics of electrical motors, starters and equipment with Electrical Drawings. Should the Contractor change the characteristics of the electrical equipment, it shall be the responsibility of the Contractor to coordinate all changes with the other trades and bear all costs of such changes.

B. Coordinate all cutouts in millwork and casework with supplier for proper cutout dimensions.

C. Install all fixtures and equipment in accordance with manufacturer's recommendations.

D. All wall hung fixtures are to be installed on floor mounted fixture supports. Fixture supports are to be anchored to floor with anchors in all mounting holes. Anchors to be sized as per the manufacturer’s recommendations. Seal all fixtures to walls and floor with white silicone sealant. Seal all sinks to counter tops with clear silicone sealant.

E. Adjust all stops, flush valves, and valves for intended water flow rate.

F. Clean plumbing fixtures and equipment and remove tags.

G. Install all electric water heaters with clearance for removal of heating elements.

H. Provide backing in wall for flush valve YJ brackets, faucet supports, etc. Anchor to the backing with anchoring screws of sufficient length to penetrate backing. See Section 220410, Part 3.

I. Provide stops with chrome-plated nipples penetrating wall and cover penetrations with chrome-plated escutcheons. Note: Compression type stops and plastic stems are not acceptable.

END OF SECTION 22 0440

SECTION 23 0010

GENERAL HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Description of General HVAC Administrative and Procedural Requirements which apply to all Division 23 sections.
   1. Definitions.
   2. Abbreviations and Acronyms.
   3. Regulatory Requirements.
   4. Fees, Permits, and Inspections.
   5. Substitutions.
   6. Coordination Drawings.
   7. Submittal Requirements.
   8. Temporary Use of HVAC Equipment.
   9. Products Requirements.
   10. Closeout Documents.
   11. Summary of the Work.
   12. Installer's Qualifications.
   13. Drawing Interpretation and Coordination.
   14. Project/Site Conditions.

1.2 RELATED DOCUMENTS

A. Drawings and General Provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification sections apply to all Division 23 Specification sections.

1.3 RELATED SECTIONS

A. Section 012300 "Alternates" for administrative and procedural requirements for alternates. Coordinate related Division 23 work and modify surrounding work to integrate the work of each Alternate.

B. Section 012500 "Substitutions" for administrative and procedural requirements for substitutions requests post bid and negotiation.

C. Section 013100 "Project Management and Coordination" for administrative and procedural provisions for Building Information Modeling.

D. Section 013300 "Submittal Procedures" for administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

E. Section 015000 "Temporary Facilities and Controls" for temporary use of permeant HVAC equipment.

F. Section 016000 "Product Requirements" for administrative and procedural requirements for selection of products for use in Project; and comparable products.

G. Section 017900 "Demonstration and Training" for instructing Owner's personnel.

H. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual.

I. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

J. Section 017900 "Demonstration and Training" for instructing Owner's personnel.

1.4 DEFINITIONS

A. Approved: When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

B. Directed: A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

C. Indicated: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

D. Furnish: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

E. Install: Operations at Project site include unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

F. Provide: Furnish and install, complete and ready for the intended use.

G. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

H. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

I. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

J. Subsystem: A portion of a system with characteristics similar to a system.

1.5 ABBREVIATIONS AND ACRONYMS

A. AFF: Above Finished Floor.

B. AGA: American Gas Association.

C. AMCA: Air Movement and Control Association International, Inc.

D. ANSI: American National Standards Institute, Inc.

E. ARI: Air-Conditioning & Refrigeration Institute.

F. ASHRAE: American Society of Heating, Refrigeration, and Air Conditioning Engineers.

G. ASME: American Society for Mechanical Engineers.

H. ASTM: American Society of Testing and Materials.

I. MEPFP: Mechanical, Electrical, Plumbing, Fire Protection.

J. MSS: Manufacturers Standardization Society of the Valve and Fitting Industry.

K. NAIMA: North American Insulation Manufacturers Association.

L. NEMA: National Electrical Manufacturers Association.

M. NFPA: National Fire Protection Association.

N. NPS: Nominal Pipe Size.

O. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

P. UL: Underwriters Laboratories, Inc.

1.6 REGULATORY REQUIREMENTS

A. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards, and utility company regulations. Where specific code requirements apply, they shall be included in the job, whether or not specifically shown or elsewhere specified.
1. ADA – Americans with Disabilities Act.
2. ASME B31.9 – Building Services Piping.
3. ASHRAE 15 – Safety Code for Mechanical Refrigeration.
4. ASHRAE 62 – Ventilation for Acceptable Indoor Air Quality.
5. ASHRAE 90.1-2013 – Energy Standard for Buildings Except Low Rise Residential Buildings.
6. NFPA 30 – Flammable and Combustible Liquid Code.
7. NFPA 54 – National Fuel Gas Code.
8. NFPA 70 – National Electrical Code.
9. NFPA 90A – Installation of Air Conditioning and Ventilating Systems.
10. NFPA 101 – Life Safety Code.
11. IBC – International Building Code with Fire, Mechanical, Plumbing and Gas Codes; 2021 Edition.
12. Alabama Boiler and Pressure Vessel Safety Act.
13. Local Health Department.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Fees, Permits, And Inspections
1. All required fees, permits, and inspections of all kind shall be obtained and paid for by the Contractor under the section of the specifications for which they are required.
2. Obtain and pay for all certificates of required inspections, and file certificates with Owner.

1.7 SUBSTITUTIONS

A. Conform to the requirements of Section 012500 "Substitutions."

B. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms will be considered by the Architect provided the correct data is submitted and validation of the reason of the request.

C. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner, which are favorable to the Owner in schedule or dollars, may be considered by the Architect providing the correct data is submitted and validation of the reason of the request.

1.8 COORDINATION DRAWINGS

A. General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of building access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

1.9 SUBMITTAL REQUIREMENTS

A. General: Prepare and submit submittals required by individual Specification Sections under provisions of Section 013300 “Submittal Procedures” and the following:

B. Digital Data Files:
1. Electronic digital data files of the Project drawings may be provided by Engineer for Contractor's use in preparing submittals.
2. Electronic digital data files supplied for use in submittal preparation will be subject to terms and conditions of the Engineer’s Release Form. A signed release form and any payment required must be returned to the Engineer prior to the transmission of electronic digital data files.
3. Electronic digital data file formats may include AutoCAD drawings, Revit converted to AutoCAD drawings, or Revit Model.

C. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Submittals shall be submitted by Section. Do not include products or materials from multiple sections in a single electronic file.
2. Name file with submittal number or other unique identifier, including revision identifier.
a. File name shall use Specification Section number.

D. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.

E. Product Data: Submit to the Architect and obtain his approval of a complete list of materials and equipment that are to be provided under Division 23.
1. List shall be complete with manufacturer’s names, catalog number, dimensions, specifications, rating data, and options utilized. Capacities shall be in the terms specified.
2. Call attention to deviations from specified items as to operation and physical dimensions.
3. Performance curves for equipment such as fans and pumps shall be included.

F. Shop Drawings: Before starting work, submit and obtain approval from Architect of detailed drawings of the following, fully dimensional (including elevations of ductwork and piping) and drawn to 1/4” to 1’-0” scale. Submit electronic file of each drawing in PDF format. Engineer will return electronic copy of marked-up drawings.

1. Ductwork (coordinate diffuser locations with architectural reflected ceiling drawings). See Section 233113 “Metal Ducts.”
2. Mechanical Equipment Rooms: Complete layouts for mechanical equipment rooms showing:
   a. Support column locations.
   b. Location and dimensions of equipment foundation and pads.
   c. Location and dimension of equipment and apparatus including electrical control panels, starters, VFDs, service and coil pull areas.
   d. Coordinate with electrical contractor and indicate electrical equipment location(s) i.e., panels, electrical conduit runs and stubs for motors, code clearances, etc.
   e. Dimensioned floor-drain locations.
   f. Layouts to be based on actual equipment being provided.
3. Equipment piping.
4. Submit complete automatic temperature control system control and power wiring diagrams for approval before installing controls. See Division 23 Section “HVAC Instrumentation and Controls.”

1.10 TEMPORARY USE OF MECHANICAL EQUIPMENT

A. Use of permanent HVAC equipment to provide heat, air conditioning, and ventilation during construction will be permitted subject to compliance of the requirements of Section 015000 “Temporary Facilities and Controls” and the following:
   1. Equipment shall not be started until a written request is submitted by the Contractor and reviewed and approved by the Engineer.
   2. Permanent HVAC system shall not be started until permanent doors and exterior windows are in place and the building is relatively dust free. At a minimum, the floors shall be broom cleaned and drywall finishing and painting complete.
   3. Chillers air handling units, and other equipment specified to have factory supervised start-ups shall have such said start-up.
   4. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
   5. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
   6. Install minimum MERV 8 filters in all air handling units. Change filters as required during construction process. Install scheduled filter elements at completion of construction and prior to testing and balancing of systems.
   7. All return air, outside air and exhaust air openings shall have temporary MERV 8 filter media installed over inlet side of opening and secured airtight there to. Change out filters as required during the construction process. If Contractor does not comply with this requirement, Contractor will be required to clean entire duct system at his expense.
      a. At Contractor’s option, in lieu of filtering OSA, close OSA damper tight. (This option does not apply to 100% outside air units or units with limited capacity return air systems.)
      b. At Contractor’s option, in lieu of filtering return and exhaust grilles, close return air damper(s) tight, off exhaust systems and run air handlers at 100% outside air at reduced air flow.
   8. All components of chilled water and heat production, unitary heating and cooling equipment, and air handlers and associated piping and air distribution system, used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained, and inspected prior to acceptance by the Owner.
      a. Pump Seal Flush: Contractor shall change the pump seal flush line cartridge filter after the system has been flushed and on a regular basis thereafter until Substantial Completion.
   9. Antifreeze shall be installed in all systems for which it is scheduled or specified.

10. Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identified replacements, at no additional cost to the Owner.
   1. All supply, return and exhaust grilles, registers, and diffusers to be cleaned.

C. Warranty dates shall start at Date of Substantial Completion. Provide extended warranty from equipment manufacturers to cover time period between start-up and substantial completion.

1.11 PRODUCT REQUIREMENTS AND COMPATIBLE PRODUCTS

A. Provide products in accordance with Section 016000 “Product Requirements” and the following.

B. Multiple items of similar equipment shall be the product of the same manufacturer.

C. Basis-of-Design Product Specification:
   1. General: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design" including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.
   2. When several manufacturers are named in the specifications, the corresponding products and models made by the specified manufacturers will be accepted and Contractor may base his bid on any one of those products. However, if the Contractor’s bid is based on products other than the scheduled or specified **basis of design**, it shall be understood that there will be no extra cost involved, and the effect on other trades has been included in the Contractor’s proposal. Coordination with other trades for substituted equipment or use of products other than the named basis of design shall be the responsibility of the Contractor.
   3. The basis of design manufacturer’s equipment has been used to determine space requirements. Should another approved manufacturer’s equipment be used in preparing proposals, Contractor shall be responsible for determining that said equipment will fit space allocated. Submission of shop drawings or product data on such equipment shall be considered as indicating that the Contractor has reviewed the space requirements and the submitted equipment will fit the space allocated with due consideration given to access required for maintenance and code purposes.
   4. The basis of design manufacturer’s equipment and scheduled mechanical equipment electrical requirements has been used to coordinate the electrical requirements of the HVAC equipment with the electrical systems serving that equipment.
      a. Contractor shall coordinate the electrical requirements of the equipment actually furnished on this project and provide the power distribution system required by that equipment at no additional cost to the Owner.
      b. Equipment of higher or lower electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at no additional cost to the Owner.
      c. Refer to Section 230053 “Basic HVAC Material and Methods” Article “Coordination” for additional requirements.
   5. Each bidder may submit to the Architect a list of any Comparable Products which he proposes to use in lieu of the equipment or material named in the specifications with a request for the approval of proposed substitutions. To be considered, such requests must be delivered to the office of the Architect no later than 10 days prior to bid due date. The submittal shall include the following:

a. Specific equipment or material proposed for substitution giving manufacturer, catalog, and model number.
b. All performance and dimensional data necessary for comparison of the proposed substitute with the equipment or material specified.
c. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
d. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
e. Evidence that proposed product provides specified warranty.
f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
g. A statement setting forth any changes in other materials, equipment, or Work of other trades that incorporation of the substitute may require.

D. Value Engineering / Value Analysis (VE/VA)
1. If this project undergoes a value engineering or value analysis process, the Contractor/Bidders are required to do the following:
a. If the Contractor's VE or VA offering is based on products other than the scheduled or specified **basis of design**. The Contractor shall inform all trades of the offering so the effect on other trades is included in the General / Mechanical Contractor's proposal. Coordination with other trades for substituted equipment or use of products, other than the named basis of design, shall be the responsibility of the Contractor furnishing the equipment.
b. The Contractor shall be responsible for determining that offered equipment will fit space allocated. Submission of the VE or VA offering shall be considered as indicating that the Contractor has reviewed the space requirements and the equipment will fit in the space allocated with due consideration given to access required for maintenance and code purposes.
c. The burden of proof of the merit of the proposed substitute is upon the proposer.

1.12 CLOSEOUT DOCUMENTS

A. Submit under provisions of Section 017700 "Closeout Procedures" and Section 017839 "Project Record Documents" and the following:

B. Record Drawings:
1. Keep accurate record of corrections, variations, and deviations, including those required by change orders to the HVAC ductwork, HVAC piping, and HVAC control drawings.
2. Accurately show location, size and elevation of new exterior work dimensioned from permanent structure.
3. Record changes daily on a set of prints kept at the job site.
4. Submit prints, marked as noted above, to Architect for review prior to request for final payment.
5. Marked prints will be returned to Contractor for use in preparing Record Drawings.

C. Prior to the issuance of a certificate for final payment, submit to Architect and obtain his approval of one (1) hard copy and electronic files of the following:
1. Record Drawings - sheet metal work. Electronic files in PDF.
2. Record Drawings – piping. Electronic files in PDF.
3. Record Drawings – controls systems.
4. Air Balance Report - (Section 230950 "Testing, Adjusting and Balancing.")

5. Water Balance Report. (Section 230950 “Testing, Adjusting and Balancing.”)
6. Approved Equipment Submittal Data.
7. Equipment operating and maintenance manuals.
8. Equipment warranty dates and guarantees.
9. Pressure vessel certificates.
10. List of Owner’s personnel who have received operating and maintenance instructions.
11. Letter certifying that the cleaning program for the chilled water systems has been completed in accordance with the Specifications. (See Section 232113 “Hydronic Piping.”)
12. Submit factory start-up/field reports for:
    a. Variable frequency drives.
    b. Chillers.
    c. Air handling units.

1.13 SUMMARY OF WORK

A. Scope: Provide all labor, materials, and equipment and services necessary for the completion of all mechanical work shown or specified, except work specified to be done or furnished by others, complete and ready for operation.

1.14 QUALITY ASSURANCE

A. Installer’s Qualifications: Firm experienced in installation of systems similar in size and complexity to those required for this project, plus the following:
1. Acceptable to, or licensed, by manufacturer.
2. Not less than 3 years’ experience with systems.
3. Successfully completed not less than 5 comparable scale projects using systems similar to those on this project.

1.15 DRAWING INTERPRETATION AND COORDINATION

A. Drawings are intended to show size, capacity, approximate location, direction, and general relationship of one phase to another, but not exact detail or arrangement.

B. Do not scale drawings for location of system components. Check all measurements, location of pipe, ducts, and equipment with the detail architectural, structural, and electrical drawings and conditions existing in the field and layout work so as to fit in with ceiling grids, lighting, and other parts.

C. Make minor adjustments in the field, as required to provide the optimum result to facilitate ease of service, efficient operation, and best appearance.

D. Where doubt arises as to the meaning of the Drawings and Specifications, obtain the Architect’s written decision before proceeding with parts affected; otherwise assume liability for damage to other work and for making necessary corrections to work in question.

E. Refer to Architectural drawings for all dimensions and locations of ceiling diffusers.

1.16 PROJECT/SITE CONDITIONS

A. Visiting Site: Visit site and become familiar with location and various conditions affecting this Work. No additional allowance will be granted because of lack of knowledge of unforeseen conditions.

B. Cause as little interference or interruption of existing utilities serving existing facilities as possible. Schedule work which will cause interference or interruption in advance with Owner, authorities having jurisdiction, and all other affected trades.

PART 2 - PRODUCTS – Not Used.

PART 3 - EXECUTION – Not Used.

END SECTION 23 0010

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SECTION 23 0053

BASIC HVAC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Description of common piping, equipment, materials, and installation for HVAC systems.

B. This Section includes the following:
1. Low-emitting material requirements.
2. Mechanical sleeve seals.
3. Sleeves.
4. Concrete.
5. Grout.
6. Escutcheons.
7. Access doors - Building.
8. Starters.
9. Workmanship.
10. Excavation, trenching, and backfilling.
11. Equipment installation - Common Requirements.
12. Painting and finishing.
13. Concrete bases.
14. Supports and anchorages.
15. Protection of rotating equipment.
16. Protection and cleaning of equipment and materials.

1.2 RELATED SECTIONS

A. Section 078413 “Penetration Firestopping” for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.

B. Section 017300 "Execution" for cutting and patching procedures.

C. Section 083113 “Access Doors and Frames” for building access doors.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations and equipment mounted at grade.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and within chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 ACTION SUBMITTALS

A. Product Data:
   1. Mechanical sleeve seals.
   2. Escutcheons.
   3. Access doors - building.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation or moisture damage.

C. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture. If pipes do not ship with end caps, cover ends of pipe stored on site with 6 mil plastic.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

E. For ductwork and HVAC equipment, refer to Part 3, Article “Protection and Cleaning of Equipment and Materials.”

1.6 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves and inserts in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate installation of building access doors for HVAC items requiring access that are concealed behind finished surfaces.

D. Electrical Characteristics for HVAC Equipment:
   1. Coordinate electrical system installation to match requirements of equipment actually furnished on this project.
   2. **Include a letter with the respective equipment submittal from the electrical contractor and approved by electrical design consultant, detailing changes to the electrical system required to accommodate changes in the power distribution system required to accommodate HVAC equipment that has different electrical power requirements from that equipment used as basis-of-design, or the power provisions as shown on the Electrical Drawings.**

PART 2 - PRODUCTS

2.1 LOW EMITTING MATERIALS – ADHESIVES AND SEALANTS

A. All adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) must comply with the following requirements as applicable to the project scope:
   1. Adhesives, sealants, and sealant primers must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168 requirements effective July 1, 2005, and rule amendment date of January 7, 2005.
   2. Aerosol adhesives must comply with Green Seal Standard for Commercial Adhesives GS-36 requirements in effect on October 19, 2000.

2.2 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annual space between pipe and sleeve.
   1. Manufacturers:
      a. Calpico, Inc.
      b. Innerlynx, Advance Products & Systems, Inc.
      c. Link-Seal by Thunderline.
      d. Metraflex Co.
      e. Pipeline Seal and Insulator, Inc.
   2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   3. Pressure Plates: Plastic. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Included one for each sealing element.
   5. Provide high temperature and U.L. fire rating at fire rated wall penetrations.

2.3 SLEEVES

A. Galvanized-Steel Sheet: 20-gauge minimum thickness; round tube closed with longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

A. Factory Fabricated Sleeving System:
   1. Basis of Design Manufacturer: HoldRite HydroFlame Pro Series Hollow Sleeves.
   2. General: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer non-metallic (polypropylene) sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket
   3. Provide telescoping and non-telescoping as required.
   4. Provide with Mid-Body Water Seal and “locator whiskers.”

B. Refrigerant Piping: Refer to Section 230183 “Refrigerant Piping” for exterior wall.

C. Sealant: Refer to Section 078413 “Penetration Firestopping” for fire- and smoke-stopping penetration sealant requirements.

D. Stuffing Insulation: Glass fiber type, non-combustible.

2.4 CONCRETE

A. Nominal weight concrete (145 PCF) using Type I Portland Cement, 1-inch maximum size coarse aggregate to provide a minimum 28-day compressive strength of 3000 psi.

2.5 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and non-metallic, dry hydraulic-cement grout.
   1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psi, 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
   1. Finish: Polished chrome plated.

2.7 ACCESS DOORS – BUILDING

A. Refer to Division 8 Section “Access Doors and Frames” for requirements for building access doors.

B. Manufacturers:
   1. Bilco.
   2. Milcor.
   3. Nystrom.

C. Construction:
   1. Door: 14-gauge, cold rolled steel.
   2. Frame: 16-gauge, cold rolled steel of configuration to suit material application.
   3. Hinge: Concealed spring hinge.
   4. Latch: Screwdriver cam latch.
   5. Finish: Phosphate dipped and prime coated.
   6. UL labeled when in fire-rated construction with rating to match construction.
   7. Stainless steel (Type 304) shall be used in ceramic tile or glazed structural tile.

D. Size: 16-inch x 16-inch minimum, as indicated on drawings, or as required to allow inspection, service, and removal of concealed items.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. First class and in accordance with best practice. Work to be orderly, neat, workmanlike in appearance and performed by skilled craftsman.

B. Poor or improper workmanship shall be removed and replaced as directed by the Architect without additional cost to the Owner or design professionals.

3.2 EXCAVATION, TRENCHING AND BACKFILLING

A. Provide trenching, excavation, backfilling necessary for performance of work, including excavation of rock and all other materials which may be encountered in accordance with requirements of Section 311000 “Earth Moving,” and the following.

B. Grade bottom of trenches evenly and excavate bell holes to ensure uniform bearing for the full pipe length. Excavate minimum 6 inches below pipe. Refill cuts below grade with sand.

C. Backfill after inspection by Architect and authorities having jurisdiction. Backfill compacted areas (engineered fill) with sand or fine gravel no less than 95% compactancy. Backfill paved areas with sand or fine gravel compacted to meet requirements of Paving Section. Backfill shall be free of rock, wood, steel, brick, etc. Do not disturb pipe.

D. Refer to Division 23, HVAC Piping and Ductwork Sections for specific bedding and backfill requirements.
   1. The first 6-inches of backfill, above factory, field insulated, cladded, or coated piping and ductwork shall be sand.

E. Restore existing pavement, curbs, sidewalks, sodding, bushes, etc., to match surroundings.

3.3 SLEEVES

A. Sleeves are not required for core-drilled holes.
   1. Exception: In mechanical room floors and other potentially wet areas, provide 4-inch x 4-inch curb or 1-1/2-inch angle ring or square, set in silicone adhesive around penetration. Refer to Section 079200 "Joint Sealants" for sealant materials and installation.

B. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
   1. Cut sleeves to length so that sleeve extends out 1/2-inch from both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas, or other potentially wet areas, 1-1/2-inches above finished floor level. Caulk space outside of sleeves watertight.
   2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
   3. Use the following sleeve materials:
      a. Sleeves for Piping Through Concrete Beams, Concrete Walls, Footings, and Potentially Wet Floors: Steel pipe.
      b. Sleeves for Piping Through Masonry Walls and Gypsum Board Partitions: Steel sheet sleeves1/2-inch larger than pipe or pipe covering. Provide ductile iron sleeves for below grade penetrations.
   4. Factory Fabricated Sleeving System: Install penetration firestopping system to comply with manufacturer's published installation instructions and drawings for products and applications indicated.
   5. Where piping or ductwork penetrates non-rated equipment room wall, floors or roofs outside of a shaft, close off space between pipe or duct and adjacent work with stuffing insulation and caulk airtight.
   6. Above ground, non-rated, exterior wall penetrations: Seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Section 079200 "Joint Sealants" for sealant materials and installation.
   7. Provide for continuous insulation wrapping through sleeve.
   8. Seal space around the outside of sleeves with grout at masonry walls and floors and dry wall mud at gypsum board partitions.

C. Underground, Exterior-Wall Pipe Penetrations: Where below grade pipes enter building above finished floor, install HDPE thermoplastic sleeve with molded-in water-stop (Century-Line Model CS) for openings up to 25-inches in diameter and heavy wall welded or seamless pipe with 2-inch water-stop continuously welded on both sides (Century-Line Model WS) for openings greater than 25-inches in diameter. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals. Wall sleeves not required for core drilled openings.
   1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve flush to face of interior wall. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
   2. Fill void between pipe and sleeve with urethane foam and waterproof around pipe on below grade end.

D. Fire-Rated Penetrations: Where pipes pass through smoke-rated, fire-rated, and fire-resistive floors, walls, and partitions, install appropriately rated sleeves and firestopping sealant. Refer to Section 078413 “Penetration Firestopping” for materials and installation methods.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

D. Install equipment in accordance with manufacturer's instructions. If manufacturer's instructions conflict with Contract Documents, obtain Architect's decision before proceeding.

E. Install equipment to allow right of way for piping installed at a required slope.

F. All equipment shall be firmly fastened in place:
   1. Pad mounted equipment shall be secured to pads using poured in place anchor bolts or cinch anchors.
   2. Vibration isolators shall be secured to floors or pads and equipment shall be bolted to the isolators.

3.5 PAINTING AND FINISHING

A. Except as specified below or noted on the Drawing, requirements for painting of HVAC systems, equipment, and components are specified in Sections 099123 "Interior Painting" and 099113 "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Paint water pipe and insulation downstream of backflow preventor (non-potable water) to termination point, or to connection with mechanical system piping, purple.

D. Shop prime and field paint all miscellaneous steel supports which are not galvanized.

E. Galvanized surfaces damaged during installation shall be repaired with a galvanized repair compound complying with Mil Spec DOD-P-21035B.

3.6 CONCRETE BASES

A. Provide concrete foundations with nominal dimensions conforming to the following schedule for floor-mounted equipment:

Equipment	Foundation
Water-Cooled Chillers	6-inch-high pad
Expansion Tanks	4-inch-high pad
Air Handling Units	8-inch-high pad
Sheet metal plenums	4-inch-high pad
Filter frames	4-inch-high curb
Equipment located in equipment rooms, not listed above	4-inch-high pad or as indicated on the Drawings
Air-cooled condensing units	4-inch-high pad
Packaged air-cooled chiller	6-inch-high pad

B. Outdoor equipment sitting on a large structural pad (e.g., packaged air-cooled chiller), still requires a minimum 6-inch-high level housekeeping pad.

C. Concrete bases shall be continuous and shall have beveled edges and smooth float finish. Concrete bases shall be reinforced with No. 3 bars a maximum of 12-inch on center each way and held in place with dowel rods at each corner anchored in the slab. Dowel rods shall not penetrate through the slab.

D. Roughen and clean exposed slabs before pouring foundations. Apply bonding agent to surfaces in contact.

E. Concrete pads shall extend a minimum of 6-inches beyond the equipment footprint in all directions, including appurtenances, vibration isolators, base elbow supports, and motors.

F. Equipment attached directly to foundations; bases provided with grout holes; and bases consisting of a structural frame shall have voids filled with grout after attachment to foundation. Vertical inline pumps are not to be anchored to concrete base.

G. Fill voids between baseplates and foundations, and level equipment, with grout.

H. For exterior slabs mounted on grade, increase slab thickness as required based on site conditions to maintain level install. Slab height shall not exceed 30-inches above grade.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section 055000 "Metal Fabrications" requirements.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding, comply with:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

3.8 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.9 ACCESS DOORS – BUILDING

A. Provide access doors in wall and inaccessible ceilings to allow access to service and maintain concealed HVAC equipment, dampers, valves, etc.

B. Coordinate installation of access doors with Divisions responsible for Building System in which panels are being installed.

3.10 PROTECTION OF ROTATING EQUIPMENT

A. For this paragraph only, “exposed” shall include being located in a casing, room, or plenum with door large enough to admit a man.

B. All items of equipment with exposed rotating or reciprocating parts shall be provided with appropriate personnel guards. Comply with all OSHA regulations.

C. Belt guards shall be provided on all belt drives. Guard shall have opening for tachometer reading of drive shaft.

D. Design equipment guards for easy access to belts and other items requiring replacement.

3.11 DEDICATED ELECTRICAL SPACE

A. The space equal to the width and depth of the equipment and extending from the floor to a height of 6 feet above the equipment or to the structural ceiling, whichever is lower, shall be dedicated to the electrical installation. No piping, ducts, leak protection apparatus, or other equipment foreign to the electrical installation shall be located in this zone. The area above the dedicated space shall be permitted to contain foreign systems provided protection is installed to avoid damage to the electrical equipment from condensation, leaks or breaks in foreign systems. Every effort shall be made to eliminate foreign systems above equipment to the structural ceiling. If this is not possible, the Contractor shall encase any pipe in a second pipe with a minimum number of joints. Provide 18 gauge (minimum) galvanized, 4 inch (minimum) deep drain pans under piping and ductwork located or passing over electrical equipment. Pipe 1" drain from pan to nearest floor drain. Drain pan shall be adequately supported and constructed to hold 4 inches of water without collapse.

3.12 PROTECTION AND CLEANING OF EQUIPMENT AND MATERIALS

A. Comply with SMACNA "IAQ Guidelines for Occupied Buildings Under Construction," 2nd Edition 2007 (Chapters 3 and 4).

B. Equipment and materials shall be carefully handled, properly stored, and protected from weather, dust-producing procedures, or damage during construction. For equipment stored in the construction area, seal outlets on air handling units with 6-mil plastic sheeting. Stand-alone units (e.g., fan coil units, air terminal units, etc.) shall be wrapped with plastic and sealed with tape. Repair or replace damaged work, materials, and equipment.

C. Take immediate measures to dry any equipment that becomes wet. If any mold growth develops on equipment due to becoming wet, remediate by following procedures approved by U.S. EPA (2001), "Mold Remediation in Schools and Commercial Buildings."

D. At completion of all work, thoroughly clean, exposed materials (duct, pipe, etc.) and equipment and make ready for painting.

E. Refer to Section 233113 "Metal Ducts", Part 3 Article "Duct Cleanliness."

END SECTION 23 0053

SECTION 23 0054

VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes solid-state, PWM, VFD's for speed control of three-phase, squirrel-cage induction motors.

1.2 DEFINITIONS

A. BAS: Building automation system.

B. IGBT: Integrated gate bipolar transistor.

C. LAN: Local area network.

D. PID: Control action, proportional plus integral plus derivative.

E. PWM: Pulse-width modulated.

F. VFD: Variable frequency drive.

G. NRTL: Nationally Recognized Testing Laboratory.

1.3 SUBMITTALS

A. Product Data: For each type of VFD. Include dimensions, mounting arrangements, location for conduit entries, shipping and operating weights, and manufacturer's technical data on features, performance, electrical ratings, characteristics, and finishes.
   1. Include manufacturer’s allowable drive to motor wire length.
   2. Include product data on output filters if filters are required.
   3. Include statement that drive capacities and electrical characteristics have been coordinated to match requirements of equipment being furnished on this project.

B. Shop Drawings: For each VFD.
   1. Include dimensioned drawings, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
      a. Each installed unit's type and details.
      b. Nameplate legends.
      c. Short-circuit current rating of integrated unit.
      d. Listed and labeled for series rating of overcurrent protective devices in combination controllers by an NRTL acceptable to authorities having jurisdiction.
   2. Wiring Diagrams: Power, signal, and control wiring for VFD's. Provide schematic wiring diagram for each type of VFD.

C. Compliance with IEEE 519: VFD manufacturer shall provide calculations, specific to this specific installation, showing the total harmonic voltage distortion is less than 5%. Input line filters shall be provided and sized as required by the VFD manufacturer to ensure compliance with IEEE 519.

D. Coordination Drawings: Drawings to scale, showing dimensioned layout, required working clearances, and required area above and around VFD's and output filters where pipe and ducts are prohibited. Show VFD layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

E. Operation and Maintenance Data: For VFD's, all installed devices, and components to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store VFD's indoors in clean, dry space with uniform temperature to prevent condensation. Protect VFD's from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation, capable of driving full load without derating, under the following conditions, unless otherwise indicated:
1. Ambient Temperature: 0 to 40 deg C (5 deg to 104 deg F).
2. Humidity: Less than 95 percent (noncondensing).
3. Altitude: Not exceeding 3300 feet.
4. Drives located outdoors or in non-air-conditioned mechanical rooms, central plants, etc., shall have a continuous output current rating of 110% of motor nameplate FLA.

1.7 COORDINATION

A. Coordinate layout and installation of VFD's with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate features, accessories, and functions of each VFD and each installed unit with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

C. Coordinate sizing of VFD's to match horsepower, output amps, and electrical characteristic requirements with submittal data for the equipment being provided on this project.

1.8 WARRANTY

A. Special Warranty: Manufacturers standard form in which manufacturer agrees to provide onsite parts and labor warranty for a period of two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB Power Distribution, Inc.; ABB Control, Inc. Subsidiary Series ACH 550.
2. Danfoss Inc.; Danfoss Electronic Drives Div. VTL6000 Series.
3. Emerson Industrial Automation.
4. Rockwell Automation; Allen-Bradley Co.; Industrial Control Group.
5. Siemens Energy and Automation; Industrial Products Division.
6. Square D.
7. Yaskawa Electric America.

2.2 VARIABLE FREQUENCY DRIVES

A. Description: NEMA ICS 2, IGBT, PWM, VFD; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase induction motor by adjusting output voltage and frequency.
   1. Provide unit suitable for operation of premium-efficiency motor as defined by NEMA MG 1.
   2. Plenum rated.

B. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

C. Output Rating: 3-phase; 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.

D. Unit Operating Requirements:
   1. Input ac voltage tolerance of plus or minus 10 percent.
   2. Input frequency tolerance of 60 Hz, plus or minus 6 percent.
   3. Minimum Efficiency: 98 percent at 60 Hz, full load.
   4. Minimum Displacement Primary-Side Power Factor: 98 percent.
   5. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
   6. Starting Torque: 100 percent of rated torque or as indicated.
   7. Speed Regulation: Plus or minus 1 percent.
   8. Input Line Impedance: 5 percent.

E. Isolated control interface to allow controller to follow control signal over an 11:1 speed range.
   1. Electrical Signal: 4 to 20 mA at 24 V.

F. Internal Adjustability Capabilities:
   1. Minimum Speed: 30 percent of maximum rpm.
   2. Maximum Speed: 80 to 100 percent of maximum rpm.
   3. Acceleration: 1 to a minimum of 1800 seconds.
   4. Deceleration: 1 to a minimum of 1800 seconds.
   5. Current Limit: 110 percent of maximum rating.

G. Self-Protection and Reliability Features:
   1. Input transient protection by means of surge suppressors.
   2. Under- and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
   3. Motor Overload Relay: Adjustable and capable of NEMA ICS 2, Class 20 or 30 performance.
   4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
   5. Instantaneous line-to-line and line-to-ground overcurrent trips.
   6. Loss-of-phase protection.
   7. Reverse-phase protection.
   8. Short-circuit protection.
   9. Motor overtemperature fault.
   10. Fast acting drive input fuses.

H. Short Circuit Current Rating: 100 KAIC

I. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.

J. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

K. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

L. Input Line Conditioning: VFD shall have an integral 5% impedance line reactor to reduce the harmonics to the power line. The impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors.

M. VFD Output Filtering: Provide output filters when wire length from drive to motor exceeds manufacturer's allowable length. Filters shall be equal to KLC dv/dt Guard, U.L. Listed, in NEMA 1 enclosure.

N. Status Lights: Door-mounted LED indicators shall indicate the following conditions:
1. Power on – normal operation.
2. Fault.
3. Alarm control

O. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and real time clock.
1. Indicating Devices: Digital LED readout and selector switch, to indicate the following controller parameters:
a. Output frequency (Hz).
b. Motor speed (rpm).
c. Motor status (running, stop, fault).
d. Motor current (amperes).
e. Motor torque (percent).
f. Fault or alarming status (code).
g. PID feedback signal (percent).
h. DC-link voltage (VDC).
i. Set-point frequency (Hz).
j. Motor output voltage (V).

P. Control Signal Interface:
1. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BMS or other control systems:
a. 0 to 10-V dc.
b. 0-20 or 4-20 mA.
c. Potentiometer using up/down digital inputs.
d. Fixed frequencies using digital inputs (Fireman's override).
e. RS485.
f. Keypad display for local hand operation.
3. Output Signal Interface:
a. A minimum of 2 analog output signal (0/4-20 mA), which can be programmed to any of the following:
1) Output frequency (Hz).
2) Output current (load).
3) DC-link voltage (VDC).
4) Motor torque (percent).
5) Motor speed (rpm).

6) Set-point frequency (Hz).

4. Remote Indication Interface: A minimum of 3 dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
   a. Motor running.
   b. Fault and warning indication (overtemperature or overcurrent).
   c. Loss of load condition (broken belt / broken coupling).

Q. Communications: Provide an RS485 interface allowing VFD to be used with an external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFD to be programmed via BAS control. Provide capability for VFD to retain these settings within the nonvolatile memory.
   1. Coordinate requirements with controls diagrams and controls contractor to provide either Johnson Controls N2, Siemens FLN, LonWorks or BACnet MS/TP interface.

R. Integral Disconnecting Means: NEMA AB 1, instantaneous-trip circuit breaker or a NEMA KS 1, fusible switch door interlocked with lockable handle.

S. Bypass Controller (3-Contactor): NEMA ICS 2, full-voltage, nonreversing enclosed controller with across-the-line starting capability in manual-bypass mode. Provide motor overload protection under both modes of operation with control logic that allows common start-stop capability including stop on external safety fault, in either mode.
   1. Provide a manual 3-contactor bypass consisting of a door interlocked main fused disconnect padlockable in the off position, a built-in motor starter and a four position DRIVE/OFF/BYPASS/TEST switch controlling three contactors. In the DRIVE position, the motor is operated at an adjustable speed from the VFD. In the OFF position, the motor and the VFD are disconnected. In the BYPASS position, the motor is operated at full speed from the AC power line and power is disconnected from the VFD so that service can be performed. In the TEST position, the motor is operated at full speed from the AC line power while power is applied to the input of the VFD. This allows the VFD to be given an operational test while continuing to run the motor at full speed in bypass. In case of an external safety fault, a customer supplied normally closed dry contact shall be able to stop the motor whether in DRIVE or BYPASS mode.
   2. Service personnel shall be able to defeat the main power disconnect and open the bypass enclosure without disconnecting power. This shall be accomplished through the use of a specifically designed tool and mechanism while meeting all local and national code requirements for safety.

T. Bypass Controller (2-Contactor with Service Switch):
   1. Factory wired and tested bypass system consisting of a door interlocked, padlockable circuit breaker, output contactor, bypass contactor, and fast acting VFD input fuses. UL Listed motor overload protection shall be provided in both drive and bypass modes.
   2. The bypass enclosure door and VFD enclosure must be mechanically interlocked such that the disconnecting device must be in the “Off” position before either enclosure may be accessed.
   3. The VFD and bypass package shall have a UL listed short circuit current rating (SCCR) of 100,000 amps and this rating shall be indicated on the UL data label.
   4. Drive Isolation Fuses: Fast acting fuses, exclusive to the VFD, shall be provided to allow the VFD to disconnect from the line prior to clearing upstream branch circuit protection.
   5. Motor protection from single phase power conditions in the bypass mode.
   6. The bypass system shall be designed for standalone operation and shall be completely functional in both Hand and Automatic modes even if the VFD has been removed from the system for repair / replacement. Serial communications shall remain functional even with the VFD removed.

7. Serial Communications – the bypass shall be capable of being monitored and / or controlled via serial communications. On-board communications protocols shall include ModBus; Johnson Controls N2; Siemens Building Technologies FLN (P1); and BACnet.
8. The bypass control shall monitor the status of the VFD and bypass contactors and indicate when there is a welded contactor contact or open contactor coil. This failed contactor condition shall be indicated on the bypass LCD display, programmed to fire a Form-C relay output, and / or over the serial communications protocol.
9. The following operators shall be provided:
   a. Bypass Hand-Off-Auto
10. The bypass shall provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in VFD or Bypass mode. The remote start/stop contact shall operate in VFD and bypass modes. The terminal strip shall allow for independent connection of up to four (4) unique safety inputs.

2.3 ENCLOSURES

A. NEMA Type 1 for general purpose interior dry locations.

B. NEMA Type 3R for exterior or damp locations.

C. NEMA Type 12 for industrial use, dust tight and drip tight – interior locations.

2.4 ACCESSORIES

A. Devices shall be factory-installed in controller enclosure, unless otherwise indicated.

B. Current-Sensing, Phase-Failure Relays for Bypass Controller: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage; with adjustable response delay.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Select features of each VFD to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; and duty cycle of motor, controller, and load.

B. Select horsepower rating of controllers to suit motor(s) controlled. For VFD's serving multiple motors, size VFD according to the sum of the RLA's of all motors.

3.2 INSTALLATION

A. Anchor each VFD assembly to steel-channel sills arranged and sized according to manufacturer's written instructions. Attach by bolting.

B. Controller Fuses: Install fuses in each fusible switch.

3.3 CONTROL WIRING INSTALLATION

A. Connect hand-off-automatic switch and other automatic-control devices where applicable.
   1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
   2. Connect selector switches with control circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.4 CONNECTIONS

A. Conduit installation requirements are specified in Division 26 Sections.

B. Ground equipment according to Division 26.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following check-out and start-up services:
   1. Inspect controllers, wiring, components, connections, and equipment installation. For proper operation and installation of VFD, its options and interface wiring to the BAS.
   2. Set field-adjustable switches and circuit breaker trip ranges.
   3. Program step-overs for critical fan speeds.
   4. Report results in writing.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain variable frequency drives. Refer to Division 01.

END OF SECTION 23 0054

SECTION 23 0062

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following hangers and supports for HVAC system piping ductwork and equipment:
   1. Steel pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Metal framing systems.
   4. Insulation couplings, strut mounted.
   5. Fastener systems.
   6. Pipe stands.
   7. Equipment supports.

1.2 RELATED SECTIONS

A. Division 23, Section “HVAC Systems Insulation”: Inserts, shields, and steel pipe saddles at hangers and supports for insulated piping systems.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-58.

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

A. Product Data: For the following:
   1. Steel pipe hangers and supports.
   2. Insulation couplings.
   3. Pipe stands – factory fabricated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
   1. Trapeze pipe hangers. Include Product Data for components.
   2. Metal framing systems. Include Product Data for components.
   3. Pipe stands. Include Product Data for components.
   4. Equipment supports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers:
1. Anvil International, Inc.
2. B-Line Systems, Inc.; a division of Cooper Industries.
3. Empire Industries, Inc.
4. ERICO/Michigan Hanger Co.
5. National Pipe Hanger Corporation.
6. PHD Manufacturing, Inc.

C. Coatings (All Components):
1. General Service Indoors: Electro-plated.
2. Exterior: Electro-plated or hot dipped galvanized.
3. Direct Contact with Copper Pipe: Provide non-metallic plastic coating or utilize copper hangers.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts to retain pipe.

B. Coatings (All Components):
1. Interior Dry Locations: Electro-plated.
2. Exterior and Wet Locations: Electro-plated or high-performance factory applied electro deposition acrylic coating equal to Unistrut Perma-Green III; electro deposition epoxy coating equal to Cooper B-Line; or approved equivalent.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Available Manufacturers:
1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. Unistrut Corp.; Tyco International, Ltd.

C. Coatings (All Components):
1. Interior Dry Locations: Electro-plated.
2. Exterior and Wet Locations: Electro-plated or high-performance factory applied electro deposition acrylic coating equal to Unistrut Perma-Green III; electro deposition epoxy coating equal to Cooper B-Line; or approved equivalent.

2.5 INSULATION COUPLINGS, STRUT-MOUNTED

A. Description: One-piece, tubular sleeve with an internal configuration that supports, secures, and seals tubular insulation and supports copper tubing without crushing the insulation.

B. Available Manufacturers:
1. Klo-Shure, Inc., Series 7.

C. General:
1. Manufactured from high strength TPO plastic suitable for indoor and outdoor use. Material to be UL 2043 classified for use in plenums.
2. ASTM E84 tested for a maximum 25/50 flame spread/smoke developed index.

3. For copper tubing 1/4 to 4-inch.
4. For preformed foamed plastic (elastomeric) and fiberglass insulation 1/2 to 1-1/2-inch wall thickness.
5. Insulation coupling creates a vapor barrier with no requirement for additional wrappings of insulation, tape, or glue.
6. Strut-mounted (Series 7) provided with coupling, clamp halves (with welded fastener and locknut).

D. Coatings (All Components):
1. Interior Dry Locations: Electro-plated.
2. Exterior and Wet Locations: Electro-plated or high-performance factory applied electro deposition acrylic coating equal to Unistrut Perma-Green III; electro deposition epoxy coating equal to Cooper B-Line; or approved equivalent.

2.6 INSERTS

A. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods. Anvil Figure 282.

2.7 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Available Manufacturers:
a. Hilti, Inc.
b. ITW Ramset/Red Head.
2. Anchor rating to be at least 150% of hanger load rating.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Available Manufacturers:
a. Hilti, Inc.
b. ITW Ramset/Red Head.
2. Anchor rating to be at least 150% of hanger load rating.

2.8 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support outdoor and roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
1. Available Manufacturers:
a. ERICO/Michigan Hanger Co.
b. MIRO Industries.
c. Cooper B-Line: Dura-Block.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.
1. Available Manufacturers:
a. MIRO Industries.
b. Cooper B-Line: Dura-Block.

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
   1. Available Manufacturers:
      a. ERICO/Michigan Hanger Co.
      b. MIRO Industries.
      c. Portable Pipe Hangers.
      d. Cooper B-Line: Dura-Block.
   2. Base: Plastic.
   3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
   4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
   1. Available Manufacturers:
      a. Portable Pipe Hangers.
      b. Cooper B-Line: Dura-Block.
   2. Bases: One or more plastic.
   3. Vertical Members: Two or more protective-coated-steel channels.
   4. Horizontal Member: Protective-coated steel channel.
   5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary equipment roof support.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
   1. Use galvanized members and fasteners where installed outside, in fan plenums and areas of high humidity or condensation.
   2. Provide other members with prime coat. Coat prior to installation.

B. Hanger Rods: Mild steel threaded both ends of continuous threaded with an electro-plated coating.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Provide foundations, supports, etc. not specified under other Divisions and as required to mount equipment in a workmanlike and structurally sound manner.

B. Comply with MSS SP-58 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Coatings:
   1. Refer to respective Part 2 Article for coating requirements.

D. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types: (Anvil Figure numbers are given for reference)
   1. Provide copper clad or plastic-coated hangers on bare copper lines.

2. Equipment pipe hanger with vibration isolators as specified under Division 23 "Vibration and Seismic Controls for HVAC Piping and Equipment."
3. Pipe hangers for non-insulated piping 3-inch and smaller: Adjustable swivel ring (MSS Type 10), Anvil Figure No. 69, or adjustable clevis hanger (MSS Type 1) Anvil Figure No. 260.
4. Pipe hangers for insulated piping, all sizes (except for steam condensate, and hot water over 180 deg F): Adjustable, steel clevis hanger (MSS Type 1) Anvil Figure No. 260.
5. Parallel piping graded in same direction may be grouped on trapezes.
6. Pipe stanchion saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.

E. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8) Anvil Figure No. 261: For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
3. Provide all thread rods to support riser clamp a minimum of one inch above top of sleeve. Where pipe anchors are noted on the plans, anchor rods to concrete floor and attach rod to clamp with washer and nuts.

F. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
3. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

G. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18) Grinnell Figure No. 282: For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19) Grinnell Figure No. 92: For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.

b. Medium (MSS Type 32): 1500 lb.
c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

H. Comply with MSS SP-58 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

I. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-58. Provide and install hangers, supports, clamps, and building attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Fastener System Installation:
1. Use powder-actuated fasteners or mechanical-expansion anchors where inserts are omitted and in existing concrete construction.
2. Install powder-actuated fasteners and mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
3. Do not use powder-actuated fasteners in light weight concrete or concrete less than 4 inches thick.

F. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary equipment roof support.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with the following in accordance with Division 23, Section "HVAC Systems Insulation."
   1. Provide insulation insert and shield at hanger and supports.
   2. Provide steel pipe saddles at roller hangers and supports.

N. Insulation Couplings, Strut-Mounted; Insulated Copper Pipe:
   1. All copper pipe and tubing (1/4 to 4-inch) supported by a strut style metal framing system shall be secured to the anchor channel with resilient insulation couplings with metal clamps.
   2. When pipe is insulated with foamed plastic, apply adhesive to end of insulation prior to inserting into the coupling.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports as required to withstand wind load requirements per 2009 IBC Section 1609.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

C. Prime and paint all non-galvanized metal fabrication per the requirements of Division 9 “Painting.”

3.7 SCHEDULES – PIPE HANGERS/SUPPORTS

A. Pipe Hanger/Support Spacing – Standard weight, steel pipe:

Pipe Size (Inches)	Maximum Hanger/Support Spacing (Feet)	Minimum Hanger Rod Diameter (Inches)
1/2 to 1-1/4	7	3/8
1-1/2	9	3/8
2	10	3/8
2-1/2	11	1/2
3	12	1/2
4	14	5/8

B. Pipe Hanger/Support Spacing – Type L, copper:

Pipe Size (Inches)	Maximum Hanger Spacing (Feet)	Minimum Hanger Rod Diameter (Inches)
1/4 to 3/4	5	3/8
1	6	3/8
1-1/4	7	3/8
1-1/2 to 2	8	3/8
2-1/2	9	1/2
3	10	1/2
4	12	1/2

C. Pipe Hanger/Support Spacing – General:
1. Provide additional hangers or supports at concentrated loads such as flanges, valves, specialties, pumps, etc.
2. Provide a hanger or support within 12-inch of each change in direction for pipe sizes 1-1/2 NPS and smaller.
3. Rod size may be reduced by one size for double rod hangers. Minimum rod diameter shall be 3/8-inch.

END OF SECTION 23 0062

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SECTION 23 0077

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, including color and letter style.

1.3 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping, unless otherwise noted herein.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. In existing buildings or facilities, coordinate pipe, valve, and equipment labeling to match existing identification methodology, unless otherwise directed by the Architect.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16-inch thick, and having predrilled holes for attachment hardware.
2. Color Coding:

System	Background Color	Letters
Equipment	Black	White

3. Temperatures up to 160 deg F.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4-inch.
5. Minimum Letter Size: Minimum ½-inch high. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless-steel self-tapping screws.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16-inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4-inch.

F. Minimum Letter Size: Minimum 1/2-inch high for viewing distances up to 72-inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information as indicated elsewhere in the Specifications and on the Drawings.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
   1. Colors: Comply with ASME A13.1, unless otherwise indicated.
   2. Lettering: Use piping system terms indicated on the Drawings. Abbreviate only as necessary for each application length.

B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to partially cover circumference of pipe on lines 6-inches outside diameter, including insulation, and smaller; Snap on, on lines over 6-inches outside diameter, including insulation, and secure with nylon straps.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on the Drawings and an arrow(s) indicating flow direction.
   1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions; or as a separate unit on each pipe label to indicate flow direction.
   2. Lettering Size: At least 1-1/4-inches high for 2-1/2-inch and larger pipe outside diameter, including insulation.

D. Following existing labeling color and format in existing buildings, unless otherwise directed by the Architect.

2.4 UNDERGROUND PIPING AND CONDUIT WARNING TAPE

A. Above Metallic Pipe: 3-inch wide for less than 24-inch burial depth and 6-inch wide for more than 24-inch burial; 4 mil polyethylene tape, color coded with contrasting text.

B. Above Non-Metallic Pipe and Conduit: 3-inch wide, 4.5 mil foil tape, color coded with contrasting text. In addition to tape, trace all below grade non-metallic pipe and conduit with a single strand of No. 16 yellow insulated copper wire laid directly on top of pipe prior to covering of pipe. Extend wire above grade and wrap around pipe / conduit at each termination point.

C. Typical Legend: "Caution Chilled Water Line Below."

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of HVAC equipment.

B. Install or permanently fasten labels on starters furnished under this Division.

C. Locate equipment labels where accessible and visible.

3.3 WARNING SIGNS AND LABELS INSTALLATION

A. Write required message on and attach warning tags to equipment and other items where required in the specifications or shown on the Drawings.

B. Label access doors at fire and smoke dampers to read "FIRE DAMPER", "SMOKE DAMPER", or “COMBINATION FIRE/SMOKE DAMPER” respectively.

C. Provide warning sign at each air/dirt separator in closed loop hydronic systems to read: “BLOW DOWN ON A REGULAR BASIS.”

D. Provide warning sign at each disconnect switch served by a remotely located VFD to read: “TURN OFF POWER TO VFD WHEN DISCONNECT SWITCH IS IN OFF POSITION.”

E. For domestic dryers, where the exhaust duct is concealed within the building construction, provide a warming sign to read: “CAUTION, THE NET EQUIVALENT LENGTH OF DRYER VENT FROM THIS LOCATION IS ___ FEET. THE MAXIMUM ALLOWABLE EXHAUST DUCT LENGTH STATED IN THE CLOTHES DRYER’S INSTALLATION INSTRUCTIONS SHALL BE EQUAL TO, OR GREATER THAN THE POSTED EQUIVALENT LENGTH. DO NOT REMOVE OR DEFACE THIS PLACARD.” Contractor to enter the net equivalent feet based on as-built conditions.

3.4 PIPE LABEL INSTALLATION

A. Identify piping specified under this Division in accordance with ANSI/ASME A13.1.

B. Locate pipe labels where piping is exposed, or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows: **(Note: In finished spaces, obtain direction from Architect prior to installing pipe labels.)**

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. Near each change in direction.
5. At access doors, manholes, and similar access points that permit view of concealed piping.
6. Near major equipment items and other points of origination and termination.
7. Spaced at maximum intervals of 20 feet along each run.

C. Pipe Label Color Schedule:

Piping System	Background Color	Letter Color
Chilled-Water	Green	White
Non-Potable Water	Purple	White

D. Heat Traced Pipes: Apply "Electric Traced" signs to outside of thermal insulation jacket.

3.5 UNDERGROUND PIPING AND CONDUIT WARNING TAPE INSTALLATION

A. Install continuously along length of pipe 12 to 18-inches above the pipe, before final backfilling for:

1. Chilled water.

2. Non-potable water.

B. For non-metallic pipe and conduit provide No. 16 yellow insulated wire laid on top of pipe or conduit and extended above grade and tied off to pipe at each point of termination.

END OF SECTION 23 0077

SECTION 23 0122

METERS AND GAGES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following meters and gages for mechanical systems:
   1. Thermometers.
   2. Gages.
   3. Test ports.
   4. Flowmeters.

1.2 RELATED SECTIONS

A. Section 230900 “Instrumentation and Control for HVAC” for turbine and electromagnetic flow meters.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include performance curves.

B. Shop Drawings: Schedule for thermometers, gages, and flowmeters indicating manufacturer's number, scale range, and location for each.

C. Operation and Maintenance Data: For flowmeters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 Articles where titles below introduce lists, the following requirements apply to product selection.
   1. Manufacturers: Subject to compliance with requirements, provide **products** by one of the manufacturers specified.

2.2 DIGITAL VARI-ANGLE THERMOMETERS

A. Manufacturers:
   1. Palmer-Wahl Instruments, Inc.
   2. Trerice, H. O. Co.
   3. Weiss Instruments, Inc.
   4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

B. Case: High impact ABS.

C. Range: -50 to 300 deg F.

D. Display: 3/8” LCD digits.

E. Power: Self-power with 10 LUX lighting.

F. Recalibration: Internal potentiometer.

G. Sensor: Glass passivated thermistor.

H. Stem: Metal for thermowell insertion and of length to suit installation.

I. Connector: Adjustable type, 180 degrees in vertical and 360 degrees in horizontal plane with locking device.

J. Accuracy: 1 percent of reading or 1 deg F, whichever is greater.

K. Outdoor Installation: Provide clear plastic cover.

2.3 PLASTIC-CASE, LIQUID-IN-GLASS THERMOMETERS

A. Manufacturers:
1. Ernst Gage Co.
2. Eugene Ernst Products Co.
3. Marsh Bellofram.
4. Miljoco Corp.
5. Trerice, H.O. Co.
6. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
7. Winters Instruments.

B. Case: Plastic, 9 inches long.

C. Tube: Red or blue reading, mercury or organic liquid-filled, with magnifying lens

D. Tube Background: Satin-faced, non-reflective aluminum with permanently etched scale markings.

E. Window: Glass or plastic

F. Stem: Metal, for thermowell installation and of length to suit installation.

G. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

H. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale.

2.4 THERMOWELLS

A. Manufacturers: Same as manufacturer of thermometer being used.

B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.5 PRESSURE GAGES

A. Manufacturers:
1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
2. Marsh Bellofram.
3. Palmer-Wahl Instruments, Inc.
4. Trerice, H. O. Co.
5. Weiss Instruments, Inc.

B. Direct-Mounted, Dial-Type Pressure Gages:
1. Standard: ASME B40.100.
2. Case: Dry type, stainless steel, 4-1/2 inch diameter.
3. Pressure-Element Assembly: Bourdon tube.
4. Pressure Connection: Brass, with NPS 1/4 bottom-outlet type.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Satin-faced, white coated metal with scale markings.
7. Pointer: Dark-colored metal.
8. Window: Glass or plastic.
9. Ring: Metal.
10. Accuracy: Grade A, plus or minus 1 percent of middle half scale.

11. Vacuum-Pressure Range: 30-inch Hg of vacuum to 15 psig of pressure.
12. Range of Fluids under Pressure: Two times operating pressure.

C. Pressure Gage Fittings:
1. Valves: NPS 1/4 brass or stainless steel, needle, or ball type.
2. Siphons: NPS 1/4 coil or brass tubing, with threaded ends.
3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.6 TEST PORTS

A. Manufacturers:
1. Flow Design, Inc.
2. Peterson Equipment Co., Inc.
3. Sisco Manufacturing Co, Inc.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 300 psig at 200 deg F.

D. Core Inserts: One or two self-sealing rubber valves.
1. Insert material for air, water, oil, or gas service at 20 to 200 deg F shall be CR.
2. Insert material for air or water service at minus 30 to plus 275 deg f shall be EPDM.

2.7 VENTURI FLOWMETERS

A. Manufacturers:
1. Armstrong Pumps, Inc.
2. Flow Design, Inc.
3. Gerand Engineering Co.
4. Preso Meters Corp.

B. Description: Differential-pressure design for installation in piping; with calibrated flow-measuring element, separate flowmeter, hoses or tubing, valves, fittings, and conversion chart compatible with flow-measuring element, flowmeter, and system fluid.

C. Construction: Bronze, brass, or factory-primed steel; with brass fittings and attached tag with flow conversion data.

D. Pressure Rating: 250 psig.

E. Temperature Rating: 250 deg F.

F. End Connections for NPS 2 and Smaller: Threaded.

G. End Connections for NPS 2-1/2 and Larger: Flanged or welded.

H. Flow Range: Flow range of flow-measuring element and flowmeter shall cover operating range of equipment or system served.

I. Permanent Indicators: Suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having 6-inch diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter element.
1. Scale: Gallons per minute (Liters per second).
2. Accuracy: Plus or minus 1 percent between 20 and 80 percent of range.

J. Portable Indicators: Differential-pressure type, calibrated for connected flowmeter element and having two 12-foot hoses, with carrying case.

1. Scale: Gallons per minute (Liters per second).
2. Accuracy: Plus or minus 2 percent between 20 and 80 percent of scale range.

K. Operating Instructions: Include complete instructions with each flowmeter.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install thermometers where shown on the Drawings.

B. Provide the following temperature ranges for thermometers:
1. Domestic Hot Water: 30 to 180 deg F, with 2-degree scale divisions.
2. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions.
3. Chilled Water: 0 to 100 deg F, with 2-degree scale divisions.

3.2 GAGE APPLICATIONS

A. Install pressure gages where shown on the Drawings.

3.3 INSTALLATIONS

A. Install direct-mounted thermometers and adjust vertical and tilted positions.

B. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.

C. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

D. Install needle-valve or ball valve and snubber in piping for each pressure gage for fluids (except steam).

E. Install needle-valve and syphon fitting in piping for each pressure gage for steam.

F. Install flow indicators in piping systems in accessible positions for easy viewing.

G. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.

H. Install flowmeter elements in accessible positions in piping systems.

I. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.

J. Install permanent indicators on walls or brackets in accessible and readable positions.

K. Install connection fittings in accessible locations for attachment to portable indicators.

L. Mount meters on wall if accessible; if not, provide brackets to support meters.

3.4 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

B. Connect flowmeter-system elements to meters.

C. Connect flowmeter transmitters to meters.

D. Ground equipment according to Division 26 Section "Grounding and Bonding."

E. Connect wiring according to Division 26 Section "Conductors and Cables."

3.5 TEST PLUGS

A. Install test plugs in piping systems at all Building Automation System temperature and pressure sensors. Coordinate requirements and locations with Division 23 Section “HVAC Instrumentation and Controls.”

3.6 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 23 0122

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SECTION 23 0183

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Refrigerant piping used for air-conditioning applications.

1.2 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-454B:
   1. Suction Lines for Air-Conditioning Applications: 300 psig.
   2. Suction Lines for Heat-Pump Applications: 535 psig.
   3. Hot-Gas and Liquid Lines: 535 psig.

B. Line Test Pressure for Refrigerant R-407C:
   1. Suction Lines for Air-Conditioning Applications: 230 psig.
   2. Suction Lines for Heat-Pump Applications: 380 psig.
   3. Hot-Gas and Liquid Lines: 380 psig.

C. Line Test Pressure for Refrigerant R-410A:
   1. Suction Lines for Air-Conditioning Applications: 300 psig.
   2. Suction Lines for Heat-Pump Applications: 535 psig.
   3. Hot-Gas and Liquid Lines: 535 psig.

1.3 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:
   1. Thermostatic expansion valves.
   2. Solenoid valves.
   3. Hot-gas bypass valves.
   4. Filter dryers.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
   1. Shop Drawing Scale: 1/8-inch equals 1 foot.
   2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.5 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.6 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS FOR REFRIGERANT PIPING

A. Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Brazing Filler Metals: AWS A5.8, Bag1, silver alloy.

2.2 VALVES AND SPECIALTIES

A. Service Valves:
1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

B. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.
1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and ac coil. Coordinate coil electrical requirements with Division 23, Section “HVAC Instrumentation and Controls.”
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.

C. Thermostatic Expansion Valves: Comply with ARI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Superheat: Adjustable.
6. Reverse-flow option (for heat-pump applications).
7. End Connections: Socket, flare, or threaded union.
8. Working Pressure Rating: 450 psig.

D. Moisture/Liquid Indicators:
1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.

E. Replaceable-Core Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated media.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

F. Permanent Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated media.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

G. Receivers: Comply with ARI 495.
1. Comply with UL 207; listed and labeled by an NRTL.
2. Body: Welded steel with corrosion-resistant coating.
3. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
4. End Connections: Socket or threaded.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 275 deg F.

H. Liquid Accumulators: Comply with ARI 495.
1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or threaded.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

2.3 REFRIGERANTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

B. ASHRAE 34, R-454B: Difluoromethane/Tetrafluoroethane.

C. ASHRAE 34, R-407C: Difluoromethane/Pentafluoroethane/1,1,1,2-Tetrafluoroethane.

D. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR ALL REFRIGERANT TYPES

A. Lines NPS 5/8 and Smaller: Copper, Type ACR, annealed-temper ("soft") tubing and wrought-copper fittings with brazed joints.

B. Lines NPS 3/4 and Larger: Copper, Type ACR, drawn-temper ("hard") tubing and wrought-copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

B. Install thermostatic expansion valves as close as possible to distributors on evaporators.
   1. Install valve so diaphragm case is warmer than bulb.
   2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
   3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

C. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

D. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

E. Install receivers sized to accommodate pump-down charge.

3.3 PIPING INSTALLATION

A. Drawings, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited, unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to equipment to allow service and maintenance.

G. Install piping free of sags and bends.

H. Drawn-Temper Tubing: Install fittings for changes in direction.

I. Annealed-Temper ("soft") Tubing: Make changes in directions greater than 30 degrees with pipe/conduit bending tool to avoid crimping of pipe.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Refer to Division 23 Sections "HVAC Instrumentation and Controls" for control wiring and sequence of operation.

L. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

M. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as

specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

N. Install refrigerant piping in protective conduit where installed belowground.

O. Slope refrigerant piping as follows:
1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

P. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Q. Install pipe sleeves at penetrations in exterior walls and floor assemblies.

R. Seal penetrations through fire and smoke barriers according to Division 07 Sections "Through-Penetration Firestop Systems" and “Fire-Resistive Joint Systems.”

S. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

T. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

U. Seal pipe penetrations through exterior walls according to Division 07 Section "Joint Sealants" for materials and methods.

V. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 PIPE JOINT CONSTRUCTION

A. Pipe joints to be constructed in accordance with the requirements of Division 23, Section “Basic HVAC Materials and Methods.”

B. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. For strut-mounted insulated piping, provide Insulation Couplings per the requirements of Division 23, Section “Hangers and Supports for HVAC Piping and Equipment.”

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:
1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately.
   a. Fill system with nitrogen to the required test pressure.
   b. System shall maintain test pressure at the manifold gage throughout duration of test.

c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
d. Remake leaking joints using new materials and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:
1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 23 0183

SECTION 23 0513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
   1. Motor controllers.
   2. Torque, speed, and horsepower requirements of the load.
   3. Ratings and characteristics of supply circuit and required control sequence.
   4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Motors mounted outdoors shall be TEFC. Provide motor end covers/shields, when exposed to direct rain.

D. All pump motors, greater than 5 HP, shall be TEFC.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: NEMA Premium efficient, as defined in NEMA MG 1 for all motors 1 horsepower and larger.

C. Service Factor: 1.15.

D. Multi-speed Motors: Separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Insulation: Class F.

H. Temperature Rise: Matching insulation rating.

I. Code Letter Designation:
   1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
   2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multi-Speed Drive: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by drive manufacturer.
   1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
   2. NEMA Premium-Efficient NEMA Motors, Inverter-Ready: Class B temperature rise; Class F insulation.
   3. Provide a shaft grounding ring. AEGIS SGR bearing protection ring by Electro Static Technology or approved equivalent.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application or as scheduled on the drawings:
   1. Permanent-split capacitor.
   2. Split phase.
   3. Capacitor start, inductor run.
   4. Capacitor start, capacitor run
   5. Electronically commutated.

B. Multi-speed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Pre-lubricated, anti-friction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 0513

SECTION 23 0629

SCROLL WATER CHILLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Packaged, air-cooled, electric-motor-driven, scroll water chillers.

1.2 DEFINITIONS

A. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.

B. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.

C. IPLV: Integrated part-load value. A single number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and referenced to ARI standard rating conditions.

D. kW/Ton: The ratio of total power input of the chiller in kilowatts to the net refrigerating capacity in tons at any given set of rating conditions.

E. NPLV: Nonstandard part-load value. A single number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and intended for operating conditions other than the ARI standard rating conditions.

1.3 SUBMITTALS

A. Product Data: Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
   1. Performance at ARI standard conditions and at conditions indicated.
   2. Performance at ARI standard unloading conditions.
   3. Minimum evaporator flow rate.
   4. Refrigerant capacity of water chiller.
   5. Oil capacity of water chiller.
   6. Fluid capacity of evaporator.
   7. Characteristics of safety relief valves.
   8. Minimum entering condenser-air temperature
   9. Performance at varying capacity with constant design entering condenser-air temperature. Repeat performance at varying capacity for different entering condenser-air temperatures, from design to minimum, in 10 deg F increments.

B. Shop Drawings: Complete set of manufacturer's prints of water chiller assemblies, control panels, sections and elevations, and unit isolation. Include the following:
   1. Assembled unit dimensions.
   2. Weight and load distribution.
   3. Required clearances for maintenance and operation.
   4. Size and location of piping and wiring connections.
   5. Wiring Diagrams: For power, signal, and control wiring.

C. Coordination Drawings: Drawings, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Structural supports.
   2. Piping roughing-in requirements.

3. Wiring roughing-in requirements, including spaces reserved for electrical equipment.
4. Access requirements, including working clearances for mechanical controls and electrical equipment, and tube pull and service clearances.

D. Certificates: For certification required in "Quality Assurance" Article.

E. Source quality-control test reports.

F. Startup service reports.

G. Operation and Maintenance Data: For each water chiller to include in emergency, operation, and maintenance manuals.

H. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. ARI Certification: Certify chiller according to ARI 590 certification program.

B. ARI Rating: Rate water chiller performance according to requirements in ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."

C. ASHRAE Compliance:
1. ASHRAE 15 for safety code for mechanical refrigeration.
2. ASHRAE Guideline 3 for refrigerant leaks, recovery, and handling and storage requirements.
3. ASHRAE/IESNA 90.1 for energy efficiency.

D. ASME Compliance: Fabricate and stamp water chiller heat exchangers to comply with ASME Boiler and Pressure Vessel Code.

E. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Ship water chillers from the factory fully charged with refrigerant and filled with oil.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to provide labor, material and refrigerant to repair or replace components of chillers that fail in materials or workmanship within one (1) year from date of Substantial Completion.

B. Extended Warranties:
1. Complete compressor, parts only.
2. Extended Warranty Period: 2nd through 5th year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PACKAGED AIR-COOLED WATER CHILLERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Carrier Corporation; a United Technologies company.
2. Daikin.
3. Trane.
4. York International Corporation.

B. Chiller Description
   1. The contractor shall furnish and install air-cooled water chiller with scroll compressors as shown as scheduled in the contract documents. The chiller shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

C. Chiller Operation
   1. Chiller shall be able to start and operate in ambient conditions from 0ºF (-18ºC) to 125ºF (52ºF). Wide ambient operation is accomplished with factory installed and tested protection. If field installed wide ambient solution is used, this shall be purchased and installed at contractor expense.
   2. Chiller shall be capable of operating with a leaving solution temperature range 40ºF to 65ºF (4.4 to 20ºC) without glycol.
   3. Chiller shall be capable of starting up with 95ºF (35ºC) entering fluid temperature to the evaporator. Maximum water temperature that can be circulated with the Chiller not operating is 125ºF (52ºC)
   4. Chiller shall provide evaporator freeze protection and low limit control to avoid low evaporator refrigerant temperature trip-outs during critical periods of chiller operation. Whenever this control is in effect, the controller shall indicate that the chiller is in adaptive mode. If the condition exists for more than 30 seconds, a limit warning alarm relay shall energize.
   5. Rapid Restart™ after power restoration. The Chiller shall be capable of starting in 45 seconds.

D. Compressors
   1. Construct chiller using fully hermetic scroll type compressors with R454B optimized and dedicated scroll profile.
   2. Provide direct drive motor cooled by suction gas with only three major moving parts and a completely enclosed compression chamber that leads to increased efficiency.
   3. Each compressor shall have overload protection internal to the compressor.
   4. Each compressor shall include centrifugal oil pump, oil level sight glass, and oil charging valve.
   5. Each compressor will have crankcase heaters installed and properly sized to minimize the amount of liquid refrigerant present in the oil sump during off cycles.

E. Evaporator
   1. The evaporator shall be a high-efficiency, brazed plate-to-plate type heat exchanger consisting of parallel plates. Braze plates shall be stainless steel with copper braze material.
   2. The water side working pressure shall be rated at 150 psig (10.3 bar) and tested at 1.5 times maximum allowable water side working pressure.
   3. The refrigerant side working pressure shall be rated at 460 psig (29.6 bars) and tested at 1.1 maximum allowable refrigerant side working pressure.
   4. Insulate the evaporator with a minimum of 1.25-inch (K=0.28) UV rated insulation. If the insulation is field installed, the additional money to cover material and installation costs in the field should be included in the bid.
   5. Evaporator heaters shall be factory installed and shall protect chiller down to -20ºF (-29ºC). Contractor shall wire separate power to energize heat tape and protect evaporator while chiller is disconnected from the main power.
   6. Provide water drain connection, vent, and fittings. Factory installed leaving water temperature control and low temperature cutout sensors.
   7. Water connections shall be grooved pipe.
   8. Proof of flow shall be provided by the equipment manufacturer, mechanically installed and electrically wired at the factory of origin.
   9. Factory installed cleanable strainer.
   10. Pump package includes: two high-head pumps, VFD, expansion vessels, drainage valves, shut-off valves at entering and leaving connections. The pump package is single point power

integrated into the chiller unit power with a separate factory wired control panel. The control of the pump is integrated into the chiller controller. The chiller controller displays evaporator pump starts and run-times. Freeze protection down to an ambient temperature of -20ºF (-29ºC) is included as standard. The cold parts of the pump package will also be insulated. Designed with one redundant pump, the chiller controls both pumps through a lead/lag and failure/recovery functionality. A variable speed drive is installed in an additional panel to control the pump. The inverter is adjusted upon start up to balance the system flow and head requirements. The purpose is to save on wasted pump energy caused by a traditional balancing valve.

11. The chilled water buffer tank is factory-installed for easy installation at the building site. The tank is engineered for continuous flow and is fully insulated as standard and is designed with freeze protection down to -20ºF (-29ºC). The purpose of the tank is to increase the chilled water circuit inertia, which is necessary with short water loops. A high circuit inertia reduces the compressor's cycling to increase the compressor life span and allow for more precise water temperature accuracy. It also saves energy as compared to hot gas bypass.

F. Fans
   1. Low sound fans shall by dynamically balanced and direct driven.
   2. All condenser fan TEAO motors have permanently lubricated ball bearings and external overload protection.

G. Condenser
   1. The condenser coils shall consist of copper tubes mechanically bonded into plate-type aluminum fins.
   2. The condenser coils shall have an integral sub-cooling circuit and shall be designed for at least 650 psig (44.8 bar) working pressure. Leak tested at 650 psig (44.8 bar).

H. Enclosures/Chiller Construction
   1. Units shall be constructed of a galvanized steel frame with galvanized steel panels and access doors.
   2. Chiller panels, base rails, and control panels shall be finished with a baked-on powder paint. Control panel doors shall have door stays.
   3. Mount starters and Terminal Blocks in a UL 1995 rated weatherproof panel provided with full opening access doors. If a circuit breaker is chosen, it should be a lockable, through-the-door type with an operating handle and clearly visible from outside of chiller indicating if power is on or off.
   4. The coating or paint system shall withstand 500 hours in a salt-spray fog test in accordance with ASTM B117.

I. Chiller Mounted Starter
   1. The starter shall be across-the-line configuration, factory-mounted and fully pre-wired to the compressor motor(s) and control panel.
   2. Unit shall have a single point power connection.
   3. A control power transformer shall be factory-installed and factory-wired to provide unit control power.
   4. Control panel shall be dead front construction for enhanced service technician safety
   5. Unit wiring shall run in liquid-tight conduit.
   6. A molded case standard interrupting capacity circuit breaker shall be factory pre-wired with terminal block power connections and equipped with a lockable external operator handle, making it available to disconnect the chiller from main power.

J. Refrigerant Circuit

1. All chillers shall have two refrigeration circuits, each with two or three (manifolded) compressor on each circuit.
2. Provide for refrigerant circuit:
   a. Liquid line shutoff valve.
   b. Discharge service valve.
   c. Filter.
   d. Liquid line sight glass.
   e. Electronic expansion valve sized for maximum operating pressure.
   f. Charging valve.
3. Full operating charge of R454B and oil.

K. Controls
1. Factory-mounted to the control panel door, the operator interface has an LCD touch-screen display.
2. Display shall consist of a menu driven interface with easy touch screen navigation to organized sub-system reports for compressor, evaporator, and motor information as well as associated diagnostics.
3. The chiller control panel shall provide password protection of all set-points.
4. Chilled water temperature control shall be microprocessor-based, proportional and integral controller to show water and refrigerant temperature, refrigerant pressure, and diagnostics. This microprocessor-based controller is to be supplied with each chiller by the chiller manufacturer.
5. The front of the chiller control panel shall display the following in clear language, without the use of codes, look-up tables, or gauges:
   a. Run time.
   b. Number of starts.
   c. Current chiller operating mode.
   d. Chilled water set point and set point source.
   e. Electrical current limit set point and set point source.
   f. Entering and leaving evaporator water temperatures.
   g. Saturated evaporator and condenser refrigerant temperatures.
   h. Evaporator and condenser refrigerant pressure.
   i. Differential oil pressure.
   j. Phase reversal/unbalance/single phasing and over/under voltage protection.
   k. Low chilled water temperature protection.
   l. High and low refrigerant pressure protection.
   m. Load limit thermostat to limit compressor loading on high return water temperature.
   n. Condenser fan sequencing to automatically cycle fans in response to load, expansion valve pressure, condenser pressure, and differential pressure to optimize chiller efficiency.
   o. Display diagnostics.
   p. Compressors: Status (on/off), %RLA, anti-short cycle timer, and automatic compressor lead-lag.
6. On chiller, mount weatherproof control panel, containing starters, power and control wiring, factory wired with terminal block power connection. Provide primary and secondary fused control power transformer.
7. The chiller controller shall utilize a microprocessor that will automatically take action to prevent chiller shutdown due to abnormal operating conditions associated with evaporator refrigerant temperature, high condensing pressure, and motor current overload.
8. Provide the following safety controls with indicating lights or diagnostic readouts.
   a. Low chilled water temperature protection.
   b. High refrigerant pressure.

c. Loss of chilled water flow.
d. Contact for remote emergency shutdown.
e. Motor current overload.
f. Phase reversal/unbalance/single phasing.
g. Over/under voltage.
h. Failure of water temperature sensor used by controller.
i. Compressor status (on or off)

9. Provide the following operating controls:
   a. A variable method to control capacity in order to maintain leaving chilled water temperature based on PI algorithms. Five-minute solid state anti-recycle timer to prevent compressor from short cycling. Compressor minimum stop-to-start time limit shall be 2 minutes. If a greater than 5-minute start-to-start, or greater than 2-minute stop-to-start timer is included, hot gas bypass shall be provided to ensure accurate chilled water temperature control in light load applications.
   b. Chilled water pump output relay that closes when the chiller is given a signal to start.
   c. Load limit thermostat to limit compressor loading on high return water temperature to prevent nuisance trip outs.
   d. High ambient unloader pressure controller that unloads compressors to keep head pressure under control and help prevent high pressure nuisance trip outs on days when outside ambient is above design.
   e. Compressor current sensing unloader chiller that unloads compressors to help prevent current overload nuisance trip outs.
   f. Low ambient lockout control with adjustable setpoint.
   g. Condenser fan sequencing which adjusts the speed of all fans automatically in response to ambient, condensing pressure and expansion valve pressure differential thereby optimizing chiller efficiency.
10. Provide user interface on the front of the panel. If display is on the inside of the panel, then a control display access door shall be provided to allow access to the display without removal of panels. Provide user interface with a minimum of the following features:
    a. Leaving chilled water setpoint adjustment from LCD input.
    b. Entering and leaving chilled water temperature output.
    c. Pressure output of condenser.
    d. Pressure output of evaporator.
    e. Ambient temperature output.
    f. Voltage output.
    g. Current limit setpoint adjustment from LCD input.
11. The chiller control panel shall provide leaving chilled water temperature reset based upon return water temperature.
12. Digital Communications to BAS system shall consist of a BACnet MS/TP interface via a single twisted pair wiring.
13. The chiller control panel shall provide an alarm relay output that shall energize whenever a fault requiring manual reset is detected by the panel.
14. The chiller control panel shall provide input for leaving chilled water temperature setpoint/chiller demand limit setpoint based upon a 2-10VDC signal from a building automation system.
15. The chiller control panel shall provide an output for chiller Percent Capacity via a 2-10VDC or 4-20mA signal to a building automation system

L. Sound
   1. Acoustics: Manufacturer must provide both sound power and sound pressure data in decibels. Sound pressure data per AHRI 370 must be provided at full load.

2. If manufacturer cannot meet the noise levels, sound attenuation devices and/or barrier walls must be installed to meet this performance level.
3. Provide acoustical treatment for compressor

M. Accessories
1. Chiller shall have full architectural louvers panels.

2.2 PACKAGED REFRIGERANT RECOVERY UNITS

A. Packaged portable unit shall consist of compressor, air-cooled condenser, recovery system, tank pressure gages, filter-dryer, and valving that allows for switching between liquid and vapor recovery mode. Refrigerant recovery unit shall be factory mounted on an ASME-constructed and -stamped refrigerant storage vessel that is sized to hold the full refrigerant charge of the largest water chiller.

2.3 SOURCE QUALITY CONTROL

A. Perform functional test of water chillers before shipping.

B. Factory performance test water chillers, before shipping, according to ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."

C. Factory test and inspect evaporator according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Stamp with ASME label.

D. For water chillers located outdoors, rate sound power level according to ARI 370 procedure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before water chiller installation, examine roughing-in for equipment support, anchor-bolt sizes and locations, piping, and electrical connections to verify actual locations, sizes, and other conditions affecting water chiller performance, maintenance, and operations.
1. Water chiller locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WATER CHILLER INSTALLATION

A. Install water chillers on support structure indicated.

B. Equipment Mounting: Install water chiller on concrete bases using elastomeric pads. Comply with requirements in Division 03 Section "Cast-in-Place Concrete."
1. Minimum Deflection: 1/4 inch.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Maintain manufacturer's recommended clearances for service and maintenance.

D. Charge water chiller with refrigerant if not factory charged and fill with oil if not factory installed.

E. Install separate devices furnished by manufacturer and not factory installed.

3.3 CONNECTIONS

A. Comply with requirements in Division 23 Section "Hydronic Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to chiller to allow service and maintenance.

C. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with pressure gage, flow meter, and drain connection with valve. Make connections to water chiller with a union flange or mechanical coupling.

D. Connect each drain connection with a union and drainpipe and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection if required.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.

C. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
1. Verify that refrigerant charge is sufficient and water chiller has been leak tested.
2. Verify that pumps are installed and functional.
3. Verify that thermometers and gages are installed.
4. Operate water chiller for run-in period.
5. Check bearing lubrication and oil levels.
6. Verify that refrigerant pressure relief device for chillers installed indoors is vented outside.
7. Verify proper motor rotation.
8. Verify static deflection of vibration isolators, including deflection during water chiller startup and shutdown.
9. Verify and record performance of chilled-water flow and low-temperature interlocks.
10. Verify and record performance of water chiller protection devices.
11. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

D. Prepare a written startup report that records results of tests and inspections.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water chillers. Video record the training sessions.

END OF SECTION 23 0629

SECTION 23 0712

HVAC SYSTEMS INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. HVAC Piping Insulation.

B. HVAC Equipment Insulation.

C. Duct Insulation.

D. Jackets and Accessories.

1.2 RELATED SECTIONS

A. Section 230062 “Hangers and Supports for HVAC Piping and Equipment”: Insulation Couplings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance, thickness, and jackets (both factory- and field- applied).
   1. Provide product description, list of materials and thickness for each service and location.
   2. For adhesives and sealants, documentation including printed statement of VOC content.
   3. Thermal hanger inserts and shields.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data; For qualified installer.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing insulation work with minimum 3 years’ experience.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230062 “Hangers and Supports for HVAC Piping and Equipment.”

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate pipe insulation installation and testing of heat tracing.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 insulation application articles for where insulation materials shall be applied. Where more than one insulation material is specified for an application, Contractor may use any of the listed insulation materials for that application.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

2.2 GLASS FIBER, PREFORMED PIPE INSULATION

A. Products: Subject to compliance with the requirements, provide one of the following:
1. Johns Manville; Micro-Lok.
2. Knauf; 1000-Degree Pipe Insulation.
3. Mason Insulation; Alley-K Pipe Insulation.
4. Owens Corning; Fiberglass Pipe Insulation.

B. Insulation: ASTM C547; Type 1, Grade A rigid molded, noncombustible.
1. Glass fibers bonded with a thermosetting resin.
2. 'K' value: ASTM C177, 0.24 at 75 degrees F.
3. Maximum service temperature: 850 degrees F.
4. Maximum moisture absorption: 0.2 percent by volume.

C. Factory-applied jackets:
1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

D. ASJ Jacket:
1. Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Glass-Fiber Adhesive:
1. Comply with MIL-A-3316C, Class 2, Grade A.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 CELLULAR GLASS PIPE INSULATION

A. Products: Subject to compliance with the requirements, provide one of the following:
1. Pittsburg Corning Corporation; Foamglass Super K.

B. Insulation: Preformed Pipe Insulation with factory-applied ASJ or ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
1. 'K' value: 0.29 at 75 degrees F.
2. Minimum service temperature: -450 degrees F.
3. Maximum service temperature: 900 degrees F.
4. Maximum water vapor transmission: 0.00 perm.
5. Maximum moisture absorption: ASTM C240, 0.2 percent by volume.
6. Density: 7.5 lb/cu. ft.
7. Maximum compressive strength: ASTM C240, 87 psi.
8. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

C. Cellular-Glass Adhesive:
1. Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Cellular-Glass Joint Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.

2.4 FOAMED PLASTIC PIPE INSULATION

A. Products: Subject to compliance with the requirements, provide one of the following:
1. Armacell LLC; AP Armaflex AP; AP Armaflex FS (Flame Spread).
2. Aeroflex USA; Aerocel.
3. RBX Corporation; Insul-Tube 180.

B. Insulation: ASTM C534, Type 1; flexible, closed-cell, cellular elastomeric insulation, pre-slit or slip on.
1. 'K' value: ASTM C177; 0.27 at 75 degrees F.
2. Minimum service temperature: -70 degrees F.
3. Maximum service temperature: 220 degrees F.
4. Moisture vapor absorption: ASTM D1056; 5.0 percent by weight.
5. Moisture vapor transmission: ASTM E96; 0.10 perm-inches.
6. Flame/Smoke Spread: ASTME E84; 20/50 Flame/Smoke.
7. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive:
1. Air dried adhesive, compatible with insulation.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Protective Coating/Jacket: Weather resistant, compatible with insulation or aluminum jacket as scheduled in Part 3-Execution.

E. Do not use indoors unless product meets ASTM E-84 flame spread rating of less than 25 and smoke density rating of less than 50.

2.5 FIELD-APPLIED JACKETS – PIPING AND EQUIPMENT

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket:
1. Manufacturers: Subject to compliance with the requirements, provide one of the following:
a. Johns Manville; Zeston.
b. P.I.C. Plastics; FG Series.
c. Proto PVC Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.
2. Jacket: ASTM D1784, one-piece molded type fitting covers and sheet material.
a. Minimum service temperature: 0 degrees F.
b. Maximum service temperature: 150 degrees F.
c. Moisture vapor transmission: ASTM E96; 0.002 perm-inches.
d. Thickness: 20 mil.
e. Connections: Brush on welding adhesive.
f. Color: Off-white, unless scheduled to be color coded.
3. Color: (Speedline)
a. Chilled Water: Light Blue
b. Non-Potable Water: Purple
c. Domestic Cold Water: Pea Green
d. Domestic Hot Water (140F): Dark Gray

e. Domestic Hot Water (120F): Light Gray
f. Domestic Hot Water Return: White

4. Jacket Adhesive: As recommended by jacket material manufacturer.
   a. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
5. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

C. Metal Jacket:
1. Manufacturers: Subject to compliance with the requirements, provide one of the following:
   a. Childers Brand, Specialty Construction Brands, Inc., a business of H.B. Fuller Company; Metal Jacketing Systems.
   b. ITW Insulation Systems; Aluminum Jacketing.
   c. PABCO Metals Corp; Surefit.
   d. RPR Products, Inc.; Insul-Mate.
   e. VMSI.
2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
   a. Factory cut and rolled to size.
   b. Thickness: 0.016-inch sheet.
   c. Finish: 3/16" corrugations.
   d. Joining: Longitudinal slip joints and 2-inch laps.
   e. Factory-Fabricated Fittings: 0.024-inch-thick die shaped fitting covers with factory-attached protective liner.
   f. Metal Jacket Bands: 3/8-inch-wide aluminum.
   g. Vapor Retarder Liner: 3-mil thick, bonded polysurin.
3. Factory-Fabricated Fitting Covers: Same material finish and thickness as jacket. Field fabricate fitting covers only if factory-fabricated not available.

2.6 GLASS FIBER, FLEXIBLE EXTERNAL DUCT WRAP

A. Products: Subject to compliance with the requirements, provide one of the following:
1. Certainteed Corp; Duct Wrap.
2. Johns Manville; Microlite.
3. Knauf Insulation; Duct Wrap.
4. Mason Insulation; Alley Wrap.
5. Owens Corning; All-Service Duct Wrap.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
1. 'K' value: ASTM C518, 0.27 at 75 degrees F.
2. Maximum service temperature: ASTM C411; 250 degrees F.
3. Maximum moisture absorption: ASTM C1104; 5 percent by weight.
4. Density: 1.0 lb/cu.ft.
5. At Contractors option, provide insulation density = 0.75 lb/cu.ft. and increase insulation thickness, as required, to provide installed R-value equal to or greater than insulation with density of 1.0 lb/cu.ft. (e.g. 2.3-inch thick, 0.75 lb/cu.ft. insulation can be substituted for 2.0-inch thick, 1.0 lb/cu.ft. density insulation).

C. Vapor Jacket:
1. FSK: Glass-scrim reinforced laminate of aluminum foil and Kraft paper bound together.
2. Moisture vapor transmission: ASTM E96; 0.02 perm.

D. Vapor Retarder Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, white color.

2.7 GLASS FIBER, RIGID BOARD DUCT INSULATION

A. Products: Subject to compliance with the requirements, provide one of the following:
1. Certainteed Corp; Commercial Board.
2. Johns Manville; 800 Series Spin-Glass.
3. Knauf Insulation; Insulation Glass Board.
4. Mason Insulation; AK Board.
5. Owens Corning; Fiberglass 700 Series.

B. Insulation: ASTM C612; rigid, noncombustible board.
1. 'K' value: ASTM C518, 0.23 at 75 degrees F.
2. Maximum service temperature: ASTM C411; 450 degrees F.
3. Maximum moisture absorption: ASTM C1104; 5 percent by weight.
4. Density: 6.0 lb/cu.ft.

C. Vapor Retarder Jacket:
1. FSK: Glass-scrim reinforced laminate of aluminum foil and Kraft paper bound together.
2. Moisture vapor transmission: ASTM E96; 0.02 perm.

D. Indoor Vapor Retarder Mastic: Vinyl emulsion type acrylic, compatible with insulation, white color.

E. Board Fasteners: Galvanized steel impact-applied or welded mechanical fasteners with press-on heads.

2.8 GLASS FIBER DUCT LINER

A. Products: Subject to compliance with the requirements, provide one of the following:
1. Certainteed Corp; ToughGuard.
2. Mason Insulation; Akousti-Liner.
3. Johns Manville.
4. Knauf Insulation.
5. Owens Corning.

B. Insulation: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."; flexible, noncombustible blanket with acrylic polymer meeting ASTM G21 impregnated surface and edge coat. Air side coating shall be black acrylic, containing an EPA registered antimicrobial agent.
1. 'K' value: ASTM C177 or ASTM C518, maximum .28 at 75 degrees F mean temperature.
2. Maximum service temperature: 250 degrees F.
3. Maximum velocity on coated air side: 5,000 fpm.
4. Minimum noise reduction criteria: ASTM C1071; 0.45 for 1-inch thickness.
5. Density: 1.5 lb/cu.ft.
6. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
a. Fungi and Bacteria Resistance: No growth per ASTM E665, G21, and G22.

C. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2-inches in diameter.

D. Adhesive:
1. Waterproof, ASTM C196 fire-retardant type.
2. Comply with NFPA 90A or NFPA 90B and with ASTM C 916. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Liner Fasteners: Galvanized steel, impact applied or welded with integral or press-on head.

2.9 EXTERNAL DUCT SOUND INSULATION

A. Products: Subject to compliance with the requirements, provide one of the following:
1. Kinetics; KNM-100AL.
2. Great Lakes Textiles; Vina-Flex FF-100 (Basis of Design)

B. Insulation: flexible, mass loaded vinyl barrier faced with a scrim reinforced foil on one side.
1. Barium Sulfate loaded limp vinyl sound barrier.
2. Sound Transmission Loss (TL), in the 2nd through 7th octave bands equal to or greater than 11, 15, 21, 27, 33, and 39 db respectively, when tested per ASTM-E90-09 as a free hanging barrier.
3. Weight: 1 pound/square foot.
4. Thickness: 0.10 -inch.
5. 'K' value: 0.29 at 70-degree F.
6. Maximum Flame Spread = 25 and maximum smoke development = 50 per ASTM E84.

2.10 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Retarder Mastic: Water based; suitable for indoor and jacketed outdoor use on below ambient services.
1. Products:
a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Vimasco Corporation; 749.
2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
b. Eagle Bridges - Marathon Industries; 501.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
d. Mon-Eco Industries, Inc.; 55-10.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.

4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
b. Eagle Bridges - Marathon Industries; 570.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
2. Water-Vapor Permeance: ASTM F 1249,.05 perm 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry. Chilled water pipe and equipment shall be at ambient temperature.
3. Pressure and leak test all piping, ductwork and equipment and obtain review and acceptance prior to the application of insulation.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

3.3 INSTALLATION - GENERAL REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces, free of voids throughout.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of the system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service.

D. Install insulation with longitudinal seams at top of horizontal runs.

E. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

F. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

G. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

H. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch-wide strips of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4-inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2-inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward cl-inching staples along edge at 2-inches o.c.
   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints, and at ends adjacent to pipe flanges and fittings.

I. For above-ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.
   4. Manholes.
   5. Handholes.
   6. Cleanouts.
   7. Flanges and unions

3.4 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install

insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2-inches.
4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION – PIPING INSULATION GENERAL

A. Exposed Piping: Locate insulation and cover seams in least visible locations.

B. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

C. Fit pipe hangers over insulation.

D. Inserts and Shields:

1. Application: Protect insulated piping at hangers and supports with insulation shield. On pipe sizes over 2-inches, provide insert.
2. Insulation Protection Shield: Galvanized steel formed in half circle to fit insulation. Length and gage as follow:
   a. Up to NPS 4: 12-inches long and 22-gauge.
3. Insulation-Insert Material: Water repellent treated, ASTM C533, Type I calcium silicate; or ASTM C552, Type II cellular glass of same thickness and vapor retarder jacket specified for surrounding insulation. Insert shall be a minimum of 2-inches longer than the shield.
4. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
5. For Clevis Hangers: Insert shall cover lower 180 degrees of pipe.
6. Option: At Contractor's option, insert may be factory fabricated Thermal Hanger Shield (insulation insert encased in sheet metal shield) equal to Pipe Shield, Inc. "Insulated Pipe Supports."
7. Steel Pipe Saddles: 12-inch-long steel pipe saddle equal to Anvil Figs. 160-165. Tack weld saddles to pipe, fill interior void with insulation that matches adjoining insulation.

E. Exterior Applications: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.6 GLASS FIBER PIPE INSULATION APPLICATION

A. For insulation with factory-applied jackets on above-ambient surfaces, Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. secure laps with outward-cl-inched staples at 6 -inches o.c.

B. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with PVC fitting covers.

C. For hot piping do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

D. For strut-mounted copper piping (NPS 4 and smaller) systems, provide Insulation Couplings per the requirements of Section 230062 “Hangers and Supports for HVAC Piping and Equipment.”

3.7 CELLULAR GLASS PIPE INSULATION APPLICATION

A. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

B. Apply to piping with all joints tightly fitted to avoid gaps. All joints to be sealed full depth with mastic.

C. Vapor retarder jacket shall have minimum 2-inch lap on longitudinal joints.

D. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

E. Seal end joints with 4-inch-wide butt strips.

F. Seal all laps and butt strips with self-seal or field applied appropriate adhesive.

G. Insulate flanges, valves and fitting with fabricated fitting covers of same material and thickness of adjacent pipe. Securely fasten into place with ½-inch aluminum bands. Finish with glass fab over vinyl acrylic mastic with flooding coat or mastic applied over fabric.

3.8 FOAMED PLASTIC PIPE INSULATION APPLICATION

A. Pipe insulation may be seamless insulation slipped over piping before erection or may be slit longitudinally and installed over erected pipe.

B. Fabricate fittings from mitered sections of pipe insulation.

C. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Exterior Applications: Paint entire insulation with two coats of manufacturer’s approved weather-resistant protective finish, except where scheduled to have an aluminum jacket.

E. For strut-mounted copper piping (NPS 4 and smaller) systems, provide Insulation Couplings per the requirements of Section 230529 “Hangers and Supports for HVAC Piping and Equipment.”

3.9 FIELD-APPLIED JACKET APPLICATION

A. Aluminum Jacket:
   1. Rivet jacketing in place and band with aluminum or stainless-steel bands 12-inches on center.
   2. Finish fittings on aluminum jacketed lines with vinyl acrylic mastic reinforced with glass fab. Provide preformed aluminum insulation covers for outdoor fittings.
   3. For exterior applications, locate jacket seams on bottom side of horizontal pipes and seal end joints with weatherproof sealant recommended by insulation manufacturer.

B. PVC Jackets:
   1. Install with 1-inch overlap at longitudinal seams and end joints.
   2. For horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels.
   3. Seal with manufacturer’s recommended adhesive.

a. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.10 SCHEDULES – PIPING INSULATION

A. General: Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Definitions:
1. Runouts: Runouts to individual terminal units not exceeding 4 feet long. Runouts exceeding 4 feet in length to be insulated same as mains.

C. HVAC Piping
1. Chilled Water Supply and Return, Indoors, Above Grade:
   a. Cellular Glass Pipe Insulation
      1) NPS 2 and smaller: 1-1/2-inch thick.
      2) NPS 2-1/2 and larger: 2-inches thick.
      3) Jacket exposed lines with color coded PVC jacket.
   b. Foamed Plastic Pipe Insulation:
      1) Runouts to Room Fan Coil AC Units: 3/4-inch thick.
2. Chilled Water Supply and Return, Outdoors, Above Grade:
   a. Cellular Glass Pipe Insulation
      1) All pipe sizes: 2-inch thick.
      2) Apply insulation over electric heat trace.
      3) Jacket lines with aluminum jacket.
3. Refrigerant Liquid Lines on Mini Split System, Indoors and Outdoors Above Grade:
   a. Foamed Plastic Pipe Insulation, Indoors Above Grade:
      1) All pipe sizes: 1/2-inch thick.
      2) Coat insulated lines exposed outdoors with Armaflex WB finish or approved equal.
4. AC Unit Drain Lines, Indoors, Above Grade:
   a. Foamed Plastic Pipe Insulation
      1) All pipe sizes: 1/2-inch thick.
5. Non-potable Water Lines Between Backflow Preventer and Connection to System Indoors, Above Grade:
   a. Glass Fiber Pipe Insulation
      1) All pipe sizes: 1-inch thick.
      2) Paint exposed pipe insulation purple.
6. Non-potable Water Lines Outdoors, Above Grade:
   a. Cellular Glass Pipe Insulation
      1) All pipe sizes: 1-inch thick.
      2) Apply insulation over electric heat trace.
      3) Jacket lines with aluminum jacket painted with 1-inch-wide band of purple paint.

3.11 INSTALLATION – EQUIPMENT INSULATION GENERAL

A. Install in accordance with NAIMA Insulation Standards.

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

F. Insulated equipment containing fluids below ambient temperature: Insulate entire system.

G. Finish insulation at supports, protrusions, and interruptions.

H. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

I. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.12 SCHEDULES - EQUIPMENT INSULATION

A. General: Acceptable equipment insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Cold Equipment:

1. Air and Dirt Separator:
   a. Foamed Plastic Insulation: 1-inch thick.
   b. Finish with two coats protective coating.
   c. Install for easy removal of bottom to clean coalescence media.
2. Chiller: Cold Water Surfaces:
   a. Foamed Plastic Insulation: 1-inch thick.
   b. Finish with two coats protective coating painted to match chiller.
   c. Apply to allow easy removal of chiller heads.
3. Chilled Water Expansion Tank:
   a. Foamed Plastic Insulation: 1-inch thick.
   b. Finish with two coats protective coating.
4. Chilled Water Buffer Tank:
   a. Foamed Plastic Insulation: 1-inch thick.
   b. Finish with two coats protective coating.
5. One-shot Combination Chemical Feeder -in chilled Water System:
   a. Foamed Plastic Insulation: 1-inch thick.
   b. Install for easy removal of top to replace filters.
   c. Finish with two coats protective coating.
6. Sidestream Filter -in Chilled Water System:
   a. Foamed Plastic Insulation: 1-inch thick.
   b. Finish with two coats protective coating.
   c. Install for easy removal of top to replace filters.
7. Chilled Water Pumps:
   a. Foamed Plastic Insulation: 1-inch thick.
   b. Applied directly to pump body.
   c. Finish with two coats protective coating painted to match chiller.
8. Strainers -in chilled Water Lines:
   a. Foamed Plastic Insulation: 1-inch thick.
   b. Install for easy removal to service strainer.

9. Flexible Connectors -in chilled Water Lines:
   a. Foamed Plastic Insulation.
   b. Build up insulation to thickness of adjacent pipe insulation. Stagger and seal joints last. Extend insulation 2-inches past joint.
10. Mechanical Joint Couplings -in chilled Water Lines:
   a. Foamed Plastic Insulation 1-inch thick.
   b. Insulation shall extend 2-inches beyond coupling. Build up adjacent sections of insulation so that outer piece is not stretched.

3.13 INSTALLATION – DUCTWORK INSULATION GENERAL

A. General: Acceptable duct insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ductwork conveying air below ambient temperature:
   1. Provide insulation with vapor retarder jackets.
   2. Seal all seams, punctures, and tears with mastic. Do not use pressure sensitive tape.
   3. Continue insulation through non-rated walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system including fittings, joints, flanges, exposed sleeves for fire and combination fire and smoke dampers, flexible connections, and expansion joints.

D. Insulated ductwork conveying air above ambient temperature:
   1. Provide with or without standard vapor retarder jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

3.14 DUCT AND PLENUM LINER APPLICATION

A. Install duct liner in accordance with SMACNA “HVAC Duct Construction Standards.”

B. Duct liner shall be cut to assure overlapped and compressed longitudinal corner joints. Apply liner with coated surface facing the air stream and adhere with 90 percent coverage of adhesive.

C. The liner shall be additionally secured with mechanical fasteners for ducts exceeding 8 -inches interior dimensions:

Velocity	Transversely Around Perimeter	Longitudinally
Up to 2500 FPM	At 4-inches from corners and at intervals not exceeding 12-inches.	At 3-inches from transverse joints and at intervals not exceeding 18 -inches.
From 2501 FPM to 6000 FPM	At 4-inches from corners and at intervals not exceeding 6 -inches.	At 3-inches from transverse joints and at intervals not exceeding 16 -inches.

D. All transverse joints shall have factory-applied edge coating and shall be neatly butted without gaps. Transverse joints, with shop-or field-cuts, shall be coated with adhesive approved by insulation manufacturer. At velocities over 2500 FPM (medium pressure supply air duct), all longitudinal joints shall be coated with adhesive.

E. All exposed leading edges facing the air stream at fan discharge, and at any interval of lined duct preceded by unlined duct, shall have factory-or field-applied edge coating. At velocities above 2500 FPM (medium pressure duct), provide metal nosing that is either channel or ZEE profile, or is

integrally formed from the duct wall, securely installed over transversely oriented liner edges facing the air stream.

F. Seal all punctures, tears, or exposed edges at shop-or field-cuts with adhesive.

G. Duct dimensions shown on drawings are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.15 GLASS FIBER, EXTERNAL DUCT WRAP APPLICATION

A. Apply duct wrap to ducts pulled snug but not so tight as to compress corners more than ¼-inch.

B. Adjacent sections of duct wrap shall be tightly butted with 2-inch stapling flap overlapping. Seams shall be stapled approximately 6 -inches on center with ½ -inch minimum steel outward clinching staples. Seal all seams, punctures, and tears with mastic. **Do not use pressure sensitive tape**.

C. Where rectangular or flat oval ducts are 24-inches width or greater, insulation shall be additionally secured to the bottom of the duct with mechanical fasteners spaced 18 -inches on center, not more than 3-inches from edge to prevent sagging. Seal fasteners with mastic.

D. Cover standing seams, stiffeners, and braces using same blanket insulation with 2-inch jacket lap, staples, and mastic.

E. At fire dampers, smoke dampers and combination fire and smoke dampers, stop insulation at rated walls, and externally insulate exposed sleeve on both sides of wall and seal insulation vapor tight to duct and wall.

F. Stop and point insulation around access and damper operators to allow operation without disturbing wrapping.

G. Lift ductwork off trapeze hangers and insert spacers.

3.16 GLASS FIBER, RIGID BOARD DUCT INSULATION APPLICATION

A. Apply board insulation to duct with mechanical fasteners located 12-inches on center. Seal all joints, fasteners, tears and punctures with glass cloth and mastic.

B. Cover standing seams, stiffeners and bracing with same insulation and seal vapor tight.

3.17 EXTERNAL DUCT SOUND INSULATION APPLICATION

A. Omit any external insulation called for elsewhere in the Specification or on the Drawings and apply 2-inch-thick rigid board fiberglass insulation: Owens-Corning 703.

B. Apply sound insulation to outside of the 2-inch-thick rigid board duct insulation and secure with acrylic-based spray contact adhesive. In addition to the adhesive, provide metal or nylon bands on each side of radial joints and at a maximum of 26 -inches on center. Banding to be snug, but do not compress insulation beneath the barrier.

C. Joints: At all seams, provide a minimum 2-inch overlap of the retarder material. Alternately, the retarder may be butted together at the joints, with the seam covered by a 2-inch-wide piece of retarder material.

3.18 SCHEDULES – DUCT INSULATION

A. Common Duct Insulation Requirements:

1. Do not line supply duct connections to multi-zone AC units, or supply duct transitions to packaged air handlers, WSHP’s, or other fan outlets less than 6 square feet outlet area. Insulate these transitions with 2-inch thick External Duct Wrap.

2. Conical and straight spin-in connections for round ducts at rectangular mains on both lined and externally insulated ducts: 2-inch thick External Duct Wrap. For low pressure ducts, split insulation at damper rod and seal vapor tight.
3. Fire, Smoke and Combination Fire and Smoke Dampers: On internally insulated ducts, stop duct liner at damper sleeve. Do not extend internal insulation through wall, partitions, or floor. Insulate portions of exposed damper sleeve, on both sides of the wall or floor, with 2-inch thick External Duct Wrap and seal insulation to duct and wall vapor tight.
4. Flexible Duct Connections on Indoor Insulated Duct Systems: 2-inch thick External Duct Wrap.
5. Duct exposed to view in finished spaces shall be factory insulated or insulated with duct liner.
6. Factory Insulated Duct: Field insulation not required unless otherwise noted.

B. Medium Pressure Supply Duct (Operating Pressure > 3-inch w.g.):
1. All Sheet Metal Medium Pressure Supply Duct: 2-inch thick External Duct Wrap.

C. Low Pressure Supply Ducts:
1. All Sheet Metal Low Pressure Supply Duct Not Specified to be Lined or Otherwise Insulated: 2-inch thick External Duct Wrap.
2. Headers and return bends on duct mounted coils and air terminal unit heating coils: 2-inch thick External Duct Wrap except where exposed to view in finished spaces, sheet metal enclosure with ½" thick Duct Liner.
3. Supply plenum mounted on top of supply diffusers: 2-inch thick External Duct Wrap.

D. Return Ducts:
1. Rectangular Return Ducts: 1-inch-thick Duct Liner.
2. Rectangular Return Duct, First 10 Feet Nearest AC Unit: 1-inch-thick Duct Liner.
3. Rectangular Runout from Main to Return Grilles on Externally Insulated Return Duct System: 1-inch-thick Duct Liner, maximum length of 4 feet nearest grille.
4. All Sheet Metal Return Duct Not Specified to be Lined or Otherwise Insulated: 2-inch thick External Duct Wrap.
5. Rectangular Transfer Ducts: 1-inch-thick Duct Liner.

E. Plenum at Weather Louvers:
1. Plenums Exposed in Mechanical Rooms, Etc.: 2-inch Rigid Board External Duct Insulation with FSK jacket.
2. Plenums Not Exposed: 2-inch thick External Duct Wrap.

F. Outside Air Ducts:
1. All Sheet Metal Outside Air Duct Not Specified to be Otherwise Insulated: 2-inch thick External Duct Wrap.

G. General Exhaust Ducts:
1. Rectangular Exhaust Ducts for Inline Fans, First 10 Feet Nearest Fan Intake: 1-inch-thick Duct Liner.
2. Exhaust Duct Between Inline Exhaust Fan and Building Exit Point (Weather louver, roof cap, brick vent, etc.): 2-inch thick External Duct Wrap.
3. Rectangular Runouts from Main to Exhaust Grilles: 1-inch-thick Duct Liner, maximum 4-foot length.

H. External Duct Sound Insulation:
1. Extent as shown on drawings.
2. Supply, return, and outside air ducts, from AC unit first 15-feet upstream or downstream into the occupied space.

END OF SECTION 23 0712

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SECTION 23 0725

CUSTOM INDOOR AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes variable volume, site-built custom air-handling units with coils for indoor installations.

1.2 SUBMITTAL5S

A. Product Data: For each type of site built custom indoor air-handling unit indicated. Include the following:
   1. Unit dimensions, weights, structural weights, and required clearances.
   2. Fans:
      a. Certified fan-performance curves with system operating conditions indicated.
      b. Certified fan-sound power ratings.
      c. Certified fan-performance ratings with system operating conditions indicated.
      d. Motor ratings, electrical characteristics, and motor and fan accessories.
      e. Specialties and accessories.
      f. Material gages and finishes.
   3. Dampers, including housings and linkages.
   4. Filters with performance characteristics.

B. Shop Drawings:
   1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
   2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
   3. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control reports from manufacturer.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain modular indoor air-handling units through one source from a single manufacturer.

B. Options: Drawings indicate size, profiles, and dimensional requirements of modular indoor air-handling units and are based on the specific system indicated. Refer to Division 01, Section “Product Requirements.”

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

E. ARI Certification: Modular indoor air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.

F. Comply with NFPA 70.

1.4 COORDINATION

A. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.5 WARRANTY

A. Provide complete unit parts warranty for one (1) year from startup.

B. Provide extended parts warranty for fan assembly for five (5) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Climate Craft.
   2. Multistack.
   3. Temtrol.

2.2 GENERAL

A. Units shall be specifically engineered for final assembly at the job site. Units requiring any field disassembly to access the mechanical room are not acceptable. The equipment's cooling, heating, ventilating, and performance shall meet or exceed that shown on the schedule. Tags and decals to aid in service or to indicate caution areas shall be provided. Electrical wiring diagrams shall be attached to the control panel access doors. Operation and Maintenance manuals shall be furnished with each unit.

2.3 CABINET CONSTRUCTION

A. Site Assembled units: Units shall be provided by a manufacturer in the business of producing factory and site assembled custom air handling equipment and shall be specifically engineered for final assembly at the jobsite. Site assembly shall be accomplished using the same procedures and techniques as would be used by the manufacturer in the factory and shall yield the same performance characteristics. Site assembly techniques that negate thermal break or other performance characteristics shall not be accepted.
   1. The installing contractor shall provide technicians for training at the AHU manufacturer’s facility prior to equipment shipment and/or site assembly shall be supervised by a direct employee of the AHU manufacturer or by a manufacturer-certified technician. All unit warranty coverage shall be the same as for a factory assembled unit.
   2. Complete units shall be shipped, broken down into individual panel and component form and all pieces shall be engineered for site assembly with no disassembly required. Dimensions and weights of critical sized components shall be provided at time of project submission, for review by the engineer and contractor.
   3. All AHU components, assembly instructions, gasket, and assembly hardware shall be provided by the AHU manufacturer. Assembly instructions shall include easy-to-follow photo details. These details shall include:
      a. Detailed unit specific assembly instructions with typical photos of assembly for both unit and component installation
      b. List of tools required for field installation
   4. Panel gasket supplied with the unit shall be a high-quality weather resistant closed-cell EPDM sponge rubber. Units relying on field applied caulk for sealing are not acceptable. Units shall be securely assembled using machine bolts. Units relying on sheet metal binding screws for field assembly are not acceptable.
   5. Units shall be accompanied by detailed bills of material for each pallet and crate, pallet check lists, panel maps, parts, construction information, and document check lists. All major components shall be identified to match the bills of material and packing lists

B. Casing deflection shall not exceed L/200 at +12.0 w.g. in all positive pressure sections and -12.0 w.g. in all negative pressure sections where L is defined as the panel span. Panels shall be designed to deflect no more than 1/200 (.0005” per inch) of span under operating design conditions when

measured at the panel span. Casing shall be rated for 1% leakage at 1.5 times the operating pressure with a maximum overall pressure of 12" wc.

C. The unit shall be constructed either of a 10-gauge galvanized C-channel perimeter rail with rail heights selectable from 5" to 12" in 1" increments or tubular steel in rail heights of 5" and 8".

D. Gasket supplied with the unit shall be a high-quality, weather-resistant closed-cell EPDM sponge rubber. Each section shall include a label to aid in proper field assembly. Floors shall be designed to deflect no more than 1/200 of span under operating conditions.

E. Standard Floors
1. Floors shall be fabricated of 16-gauge ~~G-90 galvanized steel)~~ {aluminum treadplate .125 base, 3/16" or .187 over treads. All floor sheets shall be isolated from the base assembly with an EPDM thermal break gasket.
2. Floors shall be insulated with two-part polyurethane water-impervious foam insulation. If glass fiber insulation is used an underfloor liner shall be provided. An underfloor liner shall also be provided when the bottom of the unit is used as an air tunnel, when the unit is outdoors and installed on a roof curb, or where the bottom of the unit is exposed to the outdoors.
3. Underfloor liner shall be fabricated of 20-gauge G-90 galvanized steel.
4. To allow for added protection from ruptured coils or piping, floors in specified section(s) shall include a 1 ¼" floor drain piped through the perimeter base. The drain connection through the perimeter base shall be 1 ¼" MPT stainless steel.

F. Wall and roof panels standard construction
1. Panels shall be 2" thick double-wall construction. Panel joints shall be sealed with an industrial EPDM gasket to form water and airtight seal.
2. Panels shall be individually removable for service without removing the roof or compromising the integrity of the cabinet wall. Panels shall be joined with 5/16" bolts that can be removed and refastened. Panel attachment with screws is not acceptable. All panels shall utilize thermal break construction between the exterior panel and the interior liner and between the panels and the base and roof frames.
3. For long-term durability, exterior panels shall be a minimum 16-gauge G90 galvanized steel
4. Interior liners shall be a minimum 20-gauge G90 galvanized steel smooth. Panel liners shall be of a single-piece construction and attached to the exterior panels with a full thermal break. To allow for cleaning, no fasteners shall be used on the exposed liner surface. Single wall units are not acceptable

G. Wall and roof panels
1. Interior wall and ceiling panels shall be 2" thick double-wall construction. Panel joints shall be sealed with an industrial EPDM gasket to form water and airtight seal.
2. Panels shall be individually removable for service without removing the roof or compromising the integrity of the cabinet wall. Panels shall be joined with 5/16" bolts that can be removed and refastened. Panel attachment with screws is not acceptable. All panels shall utilize thermal break construction between the exterior panel and the interior liner and between the panels and the base and roof frames.
3. Interior liners shall be a minimum 16 or 20-gauge G90 galvanized steel. Panel liners shall be of a single piece construction and attached to the exterior panels with a full thermal break. To allow for cleaning, no fasteners shall be used on the exposed liner surface. Single wall units are not acceptable.
4. Liquidtite, rigid steel or aluminum conduit (LFMC): NEC 350, UL-94V, UL360, ASTM-e162 and ASTM-e662; interlocked steel/aluminum with PVC jacket shall be used throughout.
5. Fittings: Liquidtite: NEMA FB1, UL514B; steel, zinc plated shall be used throughout. Must be UL and C-UL listed

H. Insulation
1. All wall and roof panels shall be insulated with glass fiber insulation with an R value of 4.2/inch.

I. Access doors shall be provided in all sections of the air-handling unit as indicated in the plan documents. Doors shall be sized as shown on plan drawings, shall be a minimum 2" thick with R13 polyurethane foam insulation and shall be double wall construction using the same material type as the corresponding section. Doors shall comply with the requirements of UL 1995 and NFPA 90. The door frame shall be 0.125" extruded 6063-T5 aluminum. Each door shall be mounted with adjustable die cast aluminum hinges. All doors and mounting frames shall incorporate a thermal break design, and the doors shall seal to a replaceable extruded EPDM sponge rubber gasket. Doors shall open against static pressure or shall include a pressure relief feature on the door latch.
1. The door latch assembly shall consist of a roller cam compression arm with a chrome plated steel inner handle and glass fiber/nylon composite outer handle. One {tool operated} {key operated} lock shall be provided on each fan section access door. All doors shall have a minimum of two latches.

J. The entire unit, including walls, roof, doors, joints, and seams shall include thermal break construction. This construction shall be supported by tested performance producing no condensation on the exterior surface when the air tunnel temperature is 50°F DB under the following exterior conditions
1. $(Th - 50) / (Th - Tdp) < 3.4$.
2. Th = Ambient dry bulb temperature (°F) external to housing
3. Tdp = Ambient dew point temperature (°F) external to housing.

2.4 FAN ASSEMBLIES – DIRECT DRIVE FAN ARRAY

A. Fan Arrays shall be direct-drive, non-overloading SWSI plenum fans designed for industrial duty and suitable for continuous operation.
1. Fans shall be arranged in an array using one or more welded structural steel assemblies and shall be of the size and quantity specified in the unit schedule. Screwed or riveted frames are unacceptable. Fan assemblies shall be attached directly to base structural members.
2. Fan wheels shall have a minimum of 12 airfoil blades for superior sound characteristics and shall be constructed of aluminum to reduce rotational weight and vibration. Fan blades shall be extruded aluminum for uniformity and improved vibration characteristics.
3. Each fan and motor assembly shall be independently isolated within the structural assembly using 1-inch deflection spring isolators. Isolators shall be mounted in a three-point arrangement that provides both vertical and horizontal (thrust) isolation and shall not require field adjustment. If hard mounted or rubber in shear is used in place of internal spring isolations, external isolation of the entire unit is required.
4. A fan inertia base shall be provided, or the fan structure shall exceed an equivalence of 2x mass of the total rotating parts of the fan array. Fan and motor assemblies shall be designed such that no natural frequencies exist within the operating RPM range of the fan, eliminating the need for "lockout" frequency settings in the variable speed drive. The purchasing contractor will be responsible for all costs associated with externally isolating any unit that does not include individual fan isolation.
5. All fan arrays shall meet the minimum motor efficiency, maximum brake horsepower and total motor horsepower values scheduled. All fans shall be selected to operate at a point no higher than 90% of the peak static pressure rating as defined by the fan performance curve at the selected operating speed. Manufacturer must ensure maximum fan RPM is below the first critical speed. Fans shall be Class 2 construction.

6. All fan and motor assemblies shall be dynamically balanced by the manufacturer to a maximum allowable vibration of 0.040 inches per second at design RPM and a maximum 0.080 inches per second overall vibration limit to bring the fan balance in conformance to a BV-5 Grade G1 per ANSI/AMCA 204. In addition, the manufacturer shall ensure that no critical frequencies exist in the fan operating range by varying motor speed in 1Hz increments from design RPM to 50% of design RPM

B. Motors
1. Electrical characteristics and horsepower shall be as specified on the project schedule.
2. Motors shall be Premium Efficiency per NEMA MG1 Table 12-12 TEFC type, shall have NEMA Class F insulation, shall meet NEMA Standard MD-1 Inverter Duty rating, and shall be designed to withstand 1600V peak voltage spikes and rise times ≥0.1 microseconds.
3. Motors shall have grease-lubricated ball bearings designed to deliver a minimum L10 life of 250,000 hours at full load and the maximum operating RPM of the associated fan. Grease zerks and spring-loaded grease relief valves shall be provided in each motor to allow easy bearing lubrication without damaging the seals due to over lubrication.
4. For efficient operation in a direct drive application, motors shall be capable of operating greater than 60HZ to at least the design operating speed of the fan.
5. Motors shall be factory wired to a motor control center for connection to a disconnect switch or VFD. The motor control center shall include for each motor circuit a control device providing overload protection, short circuit protection and a manual disconnect means, and all circuits shall be wired to a common main panel terminal block. All motors shall operate at all times and be controlled in unison, maintaining a consistent and uniform airflow pattern over coils, filters, and other devices.
6. Each motor shall be provided with a shaft grounding device to harmlessly bleed potential induced shaft voltages to ground

C. Warranty
1. All rotating parts shall be warranted by the unit manufacturer for a full five (5) years from date of unit start-up.

2.5 FAN ARRAY CONTROLS

A. Fan arrays shall be controlled using a common control signal, such as the duct static control signal, to modulate the fan speed.

2.6 FAN SPEED CONTROL (NON-ECM ARRAYS)

A. Each variable air volume supply and return fan array shall be provided with an individual variable frequency drive as specified under division 23.

B. Each variable air volume supply and return fan array shall be provided with an individual variable frequency drive. Drives shall be remote mounted with adequate ventilation provided. The VFD shall be self-contained, totally enclosed in a NEMA 1 ventilated cabinet and capable of operation between 0- and 40-degrees C. The VFD shall be 95% efficient at 100% rated output power, 60 Hz. The VFD shall be UL listed

2.7 UNT SOUND POWER

A. Fan sound power levels (dB) for the unit shall not exceed values as specified on the equipment schedule.

B. Unit manufacturer shall provide certified inlet, supply and casing radiated, sound power levels based on the final unit configuration

2.8 COILS

A. Provide complete coil section(s) with service access door(s) as shown on the plan drawings. Coil connections shall extend through the section casing for ease of installation. Coil connections must be sealed from both the inside and exterior surfaces of the panel with the sleeve of the inner seal covering the pipe within the depth of the panel, all to minimize leakage and condensation. An integral double wall galvanized stainless steel air seal which completely seals around the coil casing and extends to the unit pressure bearing surface shall be provided. Air seals/safing materials that are mechanically fastened to the inner liner of the cabinet only shall be constructed of 16 gage materials to match the material type in the appropriate section and shall be gasketed and have fasteners every 3 inches.

B. Multiple, “stacked” coil arrangements must be constructed so as to allow independent removal of any coil without the removal of another within the coil bank.

C. All coils shall meet or exceed the capacities specified on the mechanical schedule and all water coil performances shall be certified in accordance with the AHRI Forced Circulation Air Heating and Air-Cooling Coil certification program which is based on AHRI Standard 410. Face velocities shall not exceed those specified on the mechanical schedule.

D. All cooling coil sections shall include a double sloped drain pan constructed from 304L stainless steel. All corners shall be welded watertight. Coils shall rest on stainless steel supports. The pan shall have a minimum pitch of 2" from high point to the bottom of the drain outlet connection, providing at least a 1/8” per foot slope. The drain pan shall be insulated with a 2-part sprayed on polyurethane, water impervious foam. Insulation shall be applied to the entire under side of the drain pan and coil section base assembly. If multiple stacked coils are used, intermediate drain pans are required. Intermediate pans shall be insulated and drained with 3/4” copper down-comers to the main pan.

E. Water coils shall be of a staggered tube design with high efficiency plate-type fins for maximum performance. All coils shall be tested with 400 psig compressed air under clear water. Coils shall be designed to operate at 300 psig internal pressure and up to 250ºF. Tubes shall be 5/8" diameter, seamless 0.020” wall copper, mechanically expanded into full drawn fin collars for a continuous compression bond over the full finned length for high-efficiency performance. Coil casings shall be a minimum of 16-gauge galvanized steel. Coil casing reinforcements shall be required for fin lengths over 42". Coil fins shall be 0.0075" thick aluminum. Coils shall be serviceable using 0.25" M.P.T. drain and vent taps on the supply and return headers. Threaded seamless red brass coil connections shall be brazed to copper supply and return headers

2.9 FILTERS

A. Provide complete filter section(s) with filter racks and service access door(s) as shown on the plan drawings. Holding frames provided for medium efficiency applications will be either upstream or downstream accessible. Holding frames provided for high-efficiency applications will be upstream accessible, only. Holding frames shall be constructed from heavy gauge galvanized steel and shall be equipped with polyurethane foam gaskets. Frames shall be installed with vertical stiffeners and appropriate frame-to-frame sealant to provide a rigid leak-tight assembly. An integral air seal that completely seals around the filter frame assembly and extends to the unit pressure bearing surface shall be provided. Air seals/safing materials that are mechanically fastened to the inner liner of the cabinet only shall be constructed of 16 gage materials to match the material type in the appropriate section and shall be gasketed and have fasteners every 3 inches.

Filter fasteners shall be capable of being installed without the requirement of tools, nuts, or bolts. The holding frame shall be designed to accommodate standard-size filters with the application of the appropriate type of fastener. The filter rack shall be designed to use standard 24”x24” and 12”x24” filters only. Odd-sized filters are not allowed. Holding frame assemblies shall be sized to meet or exceed the face area specified by the mechanical schedule.

B. Angle filter racks shall be provided. Angle racks shall be fabricated from a minimum of 16-gauge galvanized steel. Angle racks shall be applied in medium-sized filter applications and will be either upstream or side accessible. Upstream access filter racks shall have one central access cover per row of filters, centered in the unit for easy access. Side access filter racks over 72" long shall include an angle center reinforcement support. Filter racks shall be sized to meet or exceed the area specified in the mechanical schedule. The filter rack shall be designed to use standard 24”x20” and 12”x20” filters only. Odd-sized filters are not allowed.

C. Gauges
   1. A Magnehelic differential pressure gauge shall be provided factory-installed for measuring the pressure drop across each filter bank-single stage. The gauge shall be a diaphragm-actuated dial type, 4¾" O.D., with white dial, black figures and graduations and pointer zero adjustment.
   2. An inclined differential pressure gauge shall be provided factory installed for measuring the pressure drop across each filter bank-single stage. The gauge shall be liquid filled inclined type with black figures, graduations, and pointer zero adjustment.

D. Medium efficiency pleated filters shall be 2" thick, 30% efficient MERV 8 as rated by ASHRAE Standard 52.1 test methods. Filter media shall be of the non-woven cotton fabric type. The filter shall have an average efficiency of 25-30 %. Filters shall be UL900 Class2 listed .

E. High efficiency, rigid mini-pleat filters shall be 4” deep, totally rigid, and disposable type. Each filter shall consist of water-laid micro-fine fiberglass media formed with closely spaced pleats. The enclosing frame shall be double-walled water-resistant beverage board. The filter media shall have an average efficiency of 65% as rated by ASHRAE Standard 52.1 test methods. Filters shall be UL900 Class 2 listed.

2.10 DAMPERS

A. Mixing box and economizer outdoor air return air openings shall be airfoil low-leak dampers, Damper shall be parallel blade type. The frame shall be fabricated from 16-gauge galvanized steel. The damper shall meet the leakage requirements of ASHRAE Std. 90.1 and of the International Energy Conservation Code by leaking less than 3 CFM/sq. ft. at 1” of static pressure and shall be AMCA licensed as a Class 1A damper.

B. Mixing box and economizer outdoor air, return air openings shall be airfoil low-leak dampers. Damper shall be parallel blade type. Damper frame shall be 0.125” thick aluminum hat channel. Damper shall meet the leakage requirements of ASHRAE Std. 90.1 and of the International Energy Conservation Code by leaking less than 3 CFM/sq. ft. at 1” of static pressure, and shall be tested in accordance with AMCA Standard 500-D

2.11 ELECTRICAL POWER AND CONTROLS

A. Unit operating voltage shall 460V, 3 phase, 60Hz. All wiring and electrical equipment supplied by the manufacturer shall conform to and be installed in accordance with the requirements of UL1995.

Provide copper wires, bus bars, and fittings throughout, except the internal wire of the control transformer may be aluminum if copper termination is provided. Identify power supply terminals with permanent markers. The maximum temperature of terminals shall not exceed 167°F (75°C) when the equipment is tested in accordance with its rating. Wiring shall be run in plated flexible metal conduit.

B. Mount a permanent nameplate on the unit to display the manufacturer, serial number and model number, date of manufacture, horsepower, current rating, and voltage

2.12 UNIT TESTING AND QUALITY CONTROL

A. The fans shall be factory run tested to ensure design integrity and proper RPM. All electrical circuits shall be tested to ensure correct operation before shipment of unit. Units shall pass all quality control checks and be thoroughly cleaned prior to shipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for steam, hydronic, and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Concrete Bases: Install floor mounting units on 8-inch-high concrete bases. See Division 23 Section “Basic HVAC Materials and Methods” for concrete base materials and fabrication requirements.

B. Install modular indoor air-handling units with the following vibration-control devices. Vibration-control devices are specified in Division 23 Section "Mechanical Vibration and Seismic Controls."
   1. Units with Internally Isolated Fans: Secure units to anchor bolts installed in concrete bases.
   2. Floor-Mounted Units: Support on concrete bases using neoprene pads. Secure units to anchor bolts installed in concrete bases.
   3. Floor-Mounted Units: Support on concrete bases using housed-spring isolators. Secure units to anchor bolts installed in concrete bases.

C. Arrange installation of units to provide access space around modular indoor air-handling units for service and maintenance.

D. Equipment assembly to be supervised by a direct employee of the AHU manufacturer or by a manufacturer certified service organization. Provide supervision for as long a period of time as is necessary to ensure proper assembly or onsite training.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to air-handling unit to allow service and maintenance.

C. Connect piping to modular indoor air-handling units mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans using NPS 1-1/4, Type M copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

E. Chilled-Water Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.

F. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connections.

G. Electrical: Comply with applicable requirements in Division 26 Sections for power wiring, switches, and motor controls.

H. Ground equipment according to Division 26 Section “Grounding and Bonding.”

I. Tighten electrical connectors and terminals according to manufacturers’ published torque-tightening values. If manufacturers’ torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installations, including piping and electrical connections.
   1. Leak Test: After installation, fill water and steam coils with water, and test coils and connections for leaks. Repair leaks and retest until no leaks exist.
   2. Charge refrigerant coils with refrigerant and test for leaks. Repair leaks and retest until no leaks exist.
   3. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Prepare test and inspection reports in writing.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Final Checks before Start-Up:
   1. Verify that shipping, blocking, and bracing are removed.
   2. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
   3. Perform cleaning and adjusting specified in this Section.
   4. Disconnect fan drive from motor, verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
   5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
   6. Verify that outdoor- and return-air mixing dampers open and close and maintain minimum outdoor-air setting.
   7. Comb coil fins for parallel orientation.
   8. Verify that proper thermal-overload protection is installed for electric coils.
   9. Install new, clean filters.
   10. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

C. Starting procedures for modular indoor air-handling units include the following:
   1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace fan and motor pulleys as required to achieve design conditions.
   2. Measure and record motor electrical values for voltage and amperage.
   3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing" for air-handling system testing, adjusting, and balancing.

3.7 CLEANING

A. After completing system installation and testing, adjusting, and balancing modular indoor air-handling unit according to manufacturer's written instructions, clean internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain modular indoor air-handling units. Refer to Division 01 Section "Closeout Procedures."

END OF SECTION 23 0725

SECTION 23 0738

MINI SPLIT-SYSTEM AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes mini split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting and may be connected to ducts.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

E. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

D. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

E. Units shall be designed to operate with HCFC-free refrigerants.

1.4 COORDINATION

A. Coordinate size and location of concrete bases for units. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 23 Section "Basic HVAC Materials and Methods."

B. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carrier Air Conditioning; Div. of Carrier Corporation.
   2. Daikin.
   3. Fujitsu General American, Inc.
   4. LG.
   5. Mitsubishi Electronics America, Inc.; HVAC Division.
   6. Hitachi.
   7. Bryant.

2.2 WALL-MOUNTING, EVAPORATOR-FAN COMPONENTS

A. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Fan: Direct drive, centrifugal fan.

D. Fan Motors: Comply with requirements in Division 23 Section "Motors."
   1. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

E. Filters: Permanent, cleanable.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

A. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
   1. Compressor Type: Scroll.
   2. Refrigerant Charge: R454B.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

D. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.

E. Fan: Aluminum-propeller type, directly connected to motor.

F. Motor: Permanently lubricated, with integral thermal-overload protection.

G. Low Ambient Kit: Permits operation down to 10 deg F.

2.4 ACCESSORIES

A. Thermostat: Hard wired to remotely control compressor and evaporator fan, with the following features:
   1. 24-hour time control of system stop and start.
   2. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
   3. Fan-speed selection, including auto setting.

B. Automatic-reset timer to prevent rapid cycling of compressor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install ground-mounting, compressor-condenser components on 4-inch- thick, reinforced concrete base; 4 inches larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 23 Section "Basic HVAC Materials and Methods" Coordinate anchor installation with concrete base.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to unit to allow service and maintenance.

C. Ground equipment per Division 26 Section "Grounding and Bonding."

D. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring, switches, and motor controls.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks per manufacturer's written instructions.

END OF SECTION 23 0738

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SECTION 23 0762

UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wall and ceiling heaters with propeller fans and electric-resistance heating coils.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Drawings, elevations, sections, and details.
   2. Location and size of each field connection.
   3. Details of anchorages and attachments to structure and to supported equipment.
   4. Equipment schedules to include rated capacities, operating characteristics, furnished specialties, and accessories.
   5. Location and arrangement of piping valves and specialties.
   6. Location and arrangement of integral controls.
   7. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Drawings, reflected ceiling drawings, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Suspended ceiling components.
   2. Structural members to which unit heaters will be attached.
   3. Method of attaching hangers to building structure.
   4. Size and location of initial access modules for acoustical tile.
   5. Items penetrating finished ceiling, including the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.
   6. Perimeter moldings for exposed or partially exposed cabinets.

D. Samples for Initial Selection: Finish colors for units with factory-applied color finishes.

E. Samples for Verification: Finish colors for each type of cabinet unit heater and wall and ceiling heaters indicated with factory-applied color finishes.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 WALL AND CEILING HEATERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   1. Berko Electric Heating; a division of Marley Engineered Products.
   2. Chromalox, Inc.; a division of Emerson Electric Company.
   3. Indeeco.
   4. Markel Products; a division of TPI Corporation.
   5. Marley Electric Heating; a division of Marley Engineered Products.
   6. QMark Electric Heating; a division of Marley Engineered Products.
   7. Trane.

B. Description: An assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

C. Cabinet:
   1. Front Panel: Stamped-steel louver, with removable panels fastened with tamperproof fasteners.
   2. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.

D. Surface-Mounting Cabinet Enclosure: Steel with finish to match cabinet.

E. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high temperature protection. Provide integral circuit breaker for overcurrent protection.

F. Fan: Aluminum propeller directly connected to motor.
   1. Motor: Permanently lubricated, multispeed. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

G. Controls: Unit-mounted thermostat. Low-voltage relay with transformer kit.

H. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

I. Capacities and Characteristics: See Equipment Schedules on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for electrical connections to verify actual locations before unit heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall boxes in finished wall assembly, seal and weatherproof. Joint-sealant materials and applications are specified in Division 07 Section "Joint Sealants."

B. Install cabinet unit heaters to comply with NFPA 90A.

C. Install propeller unit heaters level and plumb.

D. Suspend unit heaters from structure with all-thread hanger rods and elastomeric hangers. Hanger rods and attachments to structure are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

E. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

F. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding."

B. Connect wiring according to Division 26 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
   3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.5 ADJUSTING

A. Adjust initial temperature set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to one visit to Project during other-than-normal occupancy hours for this purpose.

END OF SECTION 23 0762

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SECTION 23 0775

ELECTRIC HEATING CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following electric heating cables:
   1. Self-regulating, parallel resistance.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.
   1. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.

B. Shop Drawings: For electric heating cable. Include drawings, sections, details, and attachments to other work.
   1. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.

E. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   1. Chromalox, Inc.; Wiegard Industrial Division; Emerson Electric Company.
   2. Delta-Therm Corporation.
   3. Easy Heat Inc.
   4. Nelson Heat Trace.
   5. Pyrotenax; a division of Tyco Thermal Controls.
   6. Raychem; a division of Tyco Thermal Controls.
   7. Thermon Manufacturing Co.

B. Heating Element: Pair of parallel No. 16 AWG tinned stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled nonheating leads with connectors at one end

and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.

C. Electrical Insulating Jacket: Flame-retardant polyolefin.

D. Cable Cover: Tinned-copper or Stainless-steel braid, and polyolefin outer jacket with UV inhibitor.

E. Maximum Operating Temperature (Power On): 150 deg F

F. Maximum Exposure Temperature (Power Off): 185 deg F.

G. Capacities and Characteristics:
1. Maximum Heat Output: 5 W/ft.
2. Volts: 120V.
3. Phase: 1.
4. Hertz: 60.

2.2 CONTROLS

A. Refer to Division 23 Sections "HVAC Instrumentation and Controls."

B. Pipe-Mounting Thermostats for Freeze Protection:
1. Remote bulb unit with adjustable temperature range from 30 to 50 deg F.
2. Snap action: open-on-rise, single-pole switch with minimum current rating adequate for connected cable.
3. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.
4. Corrosion-resistant, waterproof control enclosure.

2.3 ACCESSORIES

A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Warning Labels: Refer to Division 23 Section "Mechanical Identification."

C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.
1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.
1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.
2. Ensure surfaces and substrates are level and plumb.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Install the following types of electric heating cable for the applications described:
1. Freeze Protection for Outdoor Pipe: Self-regulating, parallel-resistance heating cable.

3.3 INSTALLATION

A. Install electric heating cable or mats across expansion, construction, and control joints according to manufacturer's written recommendations using cable protection conduit and slack cable to allow movement without damage to cable.

B. Electric Heating Cable Installation for Freeze Protection for Piping:
   1. Install electric heating cables after piping has been tested and before insulation is installed.
   2. Install electric heating cables according to IEEE 515.1.
   3. Install insulation over piping with electric cables according to Division 23 Section "Mechanical Insulation."
   4. Install warning tape on piping insulation where piping is equipped with electric heating cables.

C. Set field-adjustable switches and circuit-breaker trip ranges.

D. Protect installed heating cables, including nonheating leads, from damage.

3.4 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding."

B. Connect wiring according to Division 26 Section "Conductors and Cables."

3.5 FIELD QUALITY CONTROL

A. Testing: Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
   1. Test cables for electrical continuity and insulation integrity before energizing.
   2. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

B. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 23 0775

SECTION 23 0820

DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Backdraft dampers.
2. Barometric and pressure relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Flange connectors.
6. Turning vanes.
7. Duct-mounted access doors.
8. Flexible connectors.
9. Flexible ducts.
10. Duct accessory hardware.

1.2 SUBMITTALS

A. Product Data: For each type of product included in this section.
1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Shop Drawings: For duct accessories. Include drawings, elevations, sections, details, and attachments to other work.
1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances, and method of field assembly into duct systems and other construction. Include the following:
a. Special fittings.
b. Manual volume damper installations.
c. Control damper installations.
d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Duct security bars.
f. Wiring Diagrams: For power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

D. Operation and Maintenance Data: For air duct accessories to be included in operation and maintenance manuals.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

1.4 COORDINATION

A. Coordinate size, quantity, type, and locations of automatic dampers with Division 23, Section "HVAC Instrumentation and Controls."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G90.
   2. Exposed-Surface Finish: Mill phosphatized.

C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

G. Galvanized dampers specified below: Use equivalent stainless-steel dampers in stainless steel ducts and aluminum dampers in aluminum ducts constructed per SMACNA standards.

2.2 BACKDRAFT DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Air Balance Inc.; a division of Mestek, Inc.
   2. American Warming and Ventilating; a division of Mestek, Inc.
   3. Cesco Products; a division of Mestek, Inc.
   4. Duro Dyne Inc.
   5. Greenheck Fan Corporation.
   6. Nailor Industries Inc.
   7. NCA Manufacturing, Inc.
   8. Ruskin Company.
   9. SEMCO Incorporated.
   10. Vent Products Company, Inc.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 3000 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Frame: 0.125-inch-thick extruded aluminum, with welded corners and mounting flange.

F. Blades: Multiple single-piece blades, maximum 6-inch width, 0.070-inch- thick, extruded aluminum with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Extruded vinyl, mechanically locked.

I. Blade Axles:
   1. Material: Metallic.
   2. Diameter: 0.75 inch.

J. Tie Bars and Brackets: Galvanized steel.

K. Bearings: Synthetic sleeve type.

L. Sleeve: Minimum 20-gauge thickness.

2.3 BAROMETRIC RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Air Balance Inc.; a division of Mestek, Inc.
   2. American Warming and Ventilating; a division of Mestek, Inc.
   3. Cesco Products; a division of Mestek, Inc.
   4. Duro Dyne Inc.
   5. Greenheck Fan Corporation.
   6. Lloyd Industries, Inc.
   7. Nailor Industries Inc.
   8. NCA Manufacturing, Inc.
   9. Pottorff; a division of PCI Industries, Inc.
   10. Ruskin Company.
   11. SEMCO Incorporated.
   12. Vent Products Company, Inc.

B. Suitable for horizontal or vertical mounting.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Frame: 0.064-inch thick, galvanized sheet steel, with welded corners and mounting flange.

F. Blades:
   1. Multiple, 0.025-inch-thick, roll-formed aluminum.
   2. Maximum Width: 6 inches.
   3. Action: Parallel.
   4. Balance: Gravity.
   5. Eccentrically pivoted.

G. Blade Seals: Vinyl.

H. Blade Axles: Nonferrous metal.

I. Tie Bars and Brackets:
   1. Material: Galvanized steel**.**
   2. Rattle free with 90-degree stop.

J. Return Spring: Adjustable tension.

K. Bearings: Synthetic.

L. Accessories:
   1. Flange on intake.
   2. Adjustment device to permit setting for varying differential static pressures.

2.4 MANUAL VOLUME DAMPERS - STANDARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Air Balance Inc.; a division of Mestek, Inc.
   2. American Warming and Ventilating; a division of Mestek, Inc.
   3. Greenheck: MBD-10, MBD-15, MBDR-50.
   4. McGill AirFlow LLC.
   5. METALAIRE, Inc.
   6. Nailor Industries Inc.
   7. Ruskin Company: MD-25, MD-35, MDRS-25.
   8. Vent Products Company, Inc.

B. Standard leakage rating, with linkage concealed in frame.

C. Suitable for horizontal or vertical applications.

D. Galvanized dampers specified below: Use equivalent stainless-steel dampers in stainless steel ducts and aluminum dampers in aluminum ducts constructed per SMACNA standards.

E. Dampers up to 36x12 inches with a maximum velocity of 1500 fpm (457m/min)
   1. Basis of Design: Ruskin MD25.
   2. Frames:
      a. Hat-shaped, galvanized steel channels, 22-gauge minimum thickness.
      b. Mitered and welded corners.
      c. Flangeless frames for installing in ducts.
   3. Blades:
      a. Single blade.
      b. Stiffen damper blades for stability.
      c. Galvanized steel, 22 gauge thick.
   4. Blade Axles: Galvanized steel.
   5. Bearings:
      a. Molded synthetic.
   6. Tie Bars and Brackets: Galvanized steel.
   7. Actuator: Locking hand quadrant with ½ inch round or 3/8-inch square shaft.

F. Dampers up to 48x48 inches with maximum velocity = 1500 fpm.
   1. Basis of Design: Ruskin MD35.
   2. Frames:
      a. Hat-shaped, galvanized steel channels, 20-gauge minimum thickness.
      b. Mitered and welded corners.
      c. Flangeless frames for installing in ducts.
   3. Blades:
      a. Multiple blade.
      b. Opposed-blade design.
      c. Stiffen damper blades for stability.
      d. Galvanized steel 16 gauge thick.
   4. Blade Axles: Galvanized steel.
   5. Linkage: Concealed in frame.
   6. Bearings:
      a. Molded synthetic.
   7. Tie Bars and Brackets: Galvanized steel.
   8. Actuator: Locking hand quadrant for ½ inch round shaft.

G. Dampers up to 16-inch diameter with a maximum velocity of 1500 fpm
   1. Basis of Design: Ruskin MDRS25.
   2. Frames:
      a. Galvanized steel, 20-gauge minimum thickness.
      b. Roll formed with stiffener beads each end.
      c. Flangeless frames for installing in ducts.
   3. Blades:
      a. Butterfly type.
      b. Stiffen damper blades for stability.
      c. Galvanized steel 20 gauge thick.
   4. Blade Axles: Galvanized steel.
   5. Bearings:
      a. Molded synthetic.
   6. Actuator: Locking hand quadrant for ½ inch round or 3/8 inch for square shaft.

H. Accessories:
   1. Hand Quadrant Standoff Bracket: 2-inch standoff for externally insulated ductwork.

2.5 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Warming and Ventilating; a division of Mestek, Inc.
   2. Arrow United Industries; a division of Mestek, Inc.
   3. Cesco Products; a division of Mestek, Inc.
   4. Duro Dyne Inc.
   5. Greenheck Fan Corporation.
   6. Nailor Industries Inc.
   7. NCA Manufacturing, Inc.
   8. Ruskin Company.
   9. Vent Products Company, Inc.
   10. Young Regulator Company.

B. Low-leakage rating and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:
   1. Hat shaped.
   2. Extruded aluminum channels, 0.064 inch thick.
   3. Mitered and welded corners.

D. Blades:
   1. Multiple blade with maximum blade width of 8 inches.
   2. Parallel- and opposed-blade design.
   3. Extruded aluminum.
   4. 0.064 inch thick.
   5. Blade Edging: Closed-cell neoprene edging.

E. Blade Axles: 1/2-inch- diameter; nonferrous metal; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
   1. Operating Temperature Range: From minus 40 to plus 200 deg F.

F. Bearings:
   1. Molded synthetic.

2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.6 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ruskin Company.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gauge and Shape: Match connecting ductwork.

2.7 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. SEMCO Incorporated.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

D. Vane Construction: Single wall for ducts up to 18 inches high or maximum velocity of 1500 fpm and double wall for larger dimensions or velocities and all medium pressure supply duct.

2.8 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cesco Products; a division of Mestek, Inc.
2. Ductmate Industries, Inc.
3. Flexmaster U.S.A., Inc.
4. Greenheck Fan Corporation.
5. McGill AirFlow LLC.
6. Nailor Industries Inc.
7. Pottorff; a division of PCI Industries, Inc.
8. Ventfabrics, Inc.
9. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
1. Door:
   a. Double wall.
   b. Galvanized sheet metal with 1-inch-thick insulation fill.

c. Latches: Cam latches – plated steel with galvanized steel strikes.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Latches:
a. Access Doors Less Than 12 Inches Square: Two sash latches.
b. Access Doors 12-18 Inches Square: Four sash latches.

C. Round Duct Access Door:
1. Basis of Design: Ruskin ADR.
2. Door:
a. Oval shape, double skin.
b. Galvanized steel with poly-insulation; 22 gauge for 10x6 inch door size; 20 gauge for 16x12 inch door size.
c. Latches: Compression with two hand knobs.
d. Seal: Insert neoprene gasket.
3. Leakage: Airtight to 20-inch W.G.

2.9 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the wrap and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Electrical Grounding
1. Install braided copper jumpers around all flexible connectors.

2.10 FLEXIBLE DUCTS

A. Insulated Flexible Duct, Low Pressure: Installed Downstream of Air Terminal Units and Low-Pressure AC Units.
1. Manufacturers:
a. Atco Rubber Products; 30 Series.
b. Flexmaster: Type 5 (Basis of Design).
c. Thermaflex: M-KE.
2. UL 181, Class 1, trilaminate of aluminum foil, fiberglass, and aluminized polyester mechanically locked (no adhesives) to a helically wound galvanized steel wire, fiberglass insulation, black polyethylene vapor-barrier.
3. Vapor Barrier Permeance: 0.1 perm per ASTM E96, procedure A.
4. Pressure rating: 6-inch WG positive and 4-inch WG through 16-inch diameter.
5. Temperature Range: Minus 20 to plus 210 deg F.
6. Thermal Performance: R-value not less than 4.2 per ASTM C-518.

B. Insulated Flexible Ducts, Medium Pressure: Located Upstream of Air Terminal Units.
   1. Manufacturers:
      a. Atco Rubber Products; OMNI Air 1200.
      b. Flexmaster: Type 4 (Basis of Design).
      c. Technaflex: 57K.
      d. Thermaflex: M-KC.
   2. UL 181, Class 1, heavy coated fiberglass cloth mechanically locked (no adhesives) to a helically wound galvanized steel wire, fiberglass insulation, black polyethylene vapor-barrier.
   3. Vapor Barrier Permeance: 0.1 perm ASTM E96, procedure A.
   4. Pressure rating: 12inch WG positive and 5-inch WG through 16-inch diameter.
   5. Temperature Range: Minus 20 to plus 210 deg F.
   6. Thermal Performance: R-value not less than 4.2 per ASTM C-518.

C. Insulated Flexible Duct located in vented attic, unvented attic above the envelope insulation or in a non-conditioned space.
   1. Flexible ducts same as specified above except with a Thermal Performance R-Value not less than 6.0 per ASTM C-518 shall be provided for:
      a. All flexible duct located in the attic.
      b. All flexible duct located in the space above the ceiling at the roof level.

D. Spin-Ins: Branch Duct Connectors for Connecting Round Low Pressure Duct to Rectangular Low-Pressure Duct:
   1. Manufactures:
      a. Flexmaster: FLD (Basis of Design)
   2. Galvanized steel G-90 minimum 26 gauge.

E. Side Takeoff Fitting: Rectangular Inlet with Round Outlet for Connecting Round Low Pressure Duct to Rectangular Low-Pressure Duct.
   1. Manufacturers:
      a. Flexmaster: STOD/B03. (Basis of Design)
   2. Galvanized steel, G-90 minimum 26 gauge.

F. Flexible Duct Clamps: Make Connections Between Flexible and Other Duct or Equipment with Duct Clamps:
   1. High and Medium Pressure (Upstream of Air Terminal Units): Stainless steel band with cadmium plated hex screw to tighten band with a worm gear action and duct sealer.
   2. Low Pressure: Nylon strap, above accessible ceilings. Provide stainless steel band with cadmium plated hex screw to tighten band with a worm gear action above inaccessible ceilings. Use stainless steel band above non-accessible ceilings.

G. Connect Air Terminal Units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

H. Connect diffusers to low-pressure ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

2.11 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install duct test holes where required for testing and balancing purposes.

3.2 DAMPERS

A. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

B. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
   1. Install steel volume dampers in steel ducts.
   2. Install aluminum volume dampers in aluminum ducts.

C. Set dampers to fully open position before testing, adjusting, and balancing. Saw mark end of shaft parallel with damper blade.

D. Connect ducts to sound attenuators rigidly.

3.3 DUCT ACCESS DOORS

A. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
   1. On both sides of duct coils.
   2. Downstream from control dampers.
   3. Upstream of air flow monitors (AFM).
   4. Elsewhere as indicated.

B. Access Door Sizes:
   1. One-Hand or Inspection Access: 8 by 5 inches.
   2. Two-Hand Access: 12 by 6 inches.
   3. Head and Hand Access: 18 by 10 inches.
   4. Head and Shoulders Access: 21 by 14 inches.

C. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

3.4 FLEXIBLE CONNECTORS

A. Install flexible connectors at all duct connections to all fans and AC units.

B. Install flexible connectors in all ducts at building expansion joints.

C. Electrical Grounding: Install braided copper jumpers around all flexible connections, taking care that jumpers do not bind flexes.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Operate dampers to verify full range of movement.

2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Inspect turning vanes for proper and secure installation.

END OF SECTION 23 0820

SECTION 23 0838

POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. In-line centrifugal fans.

1.2 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base air ratings on project site conditions.

B. Operating Limits: Classify according to AMCA 99.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material gages and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: For power ventilators to include in maintenance manuals specified in Division 01.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

C. UL Standard: Power ventilators shall comply with UL 705.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.6 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating." Label fans with the AMCA – Certified Rating Seal.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Basis of Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

2.2 IN-LINE CENTRIFUGAL FANS

A. Manufacturer:
   1. Barry Blower Div./Penn Ventilation Companies, Inc.
   2. Cook, Loren Company.
   3. Greenheck Fan Corp.

B. Description: In-line, direct driven centrifugal fans; as scheduled on the Drawings, consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

D. Direct-Driven Units: Motor encased in housing outside of airstream, factory wired to disconnect switch located on outside of fan housing.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

F. Accessories: Provide per fan equipment schedule on Drawings.
   1. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
   2. Companion Flanges: For inlet and outlet duct connections.
   3. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.

2.3 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

B. Enclosure Type: Guarded drip proof.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support suspended units from structure using threaded steel rods and spring hangers. Vibration-control devices are specified in Division 23 Section "Mechanical Vibration Controls and Seismic Restraints."

C. Install units with clearances for service and maintenance.

D. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Equipment Startup Checks:
   1. Verify that shipping, blocking, and bracing are removed.
   2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
   3. Verify that cleaning and adjusting are complete.
   4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
   5. Verify lubrication for bearings and other moving parts.
   6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
   7. Disable automatic temperature-control operators.

B. Starting Procedures:
   1. Energize motor and adjust fan to indicated rpm.
   2. Measure and record motor voltage and amperage.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Shut unit down and reconnect automatic temperature-control operators.

F. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.

G. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Lubricate bearings.

3.5 CLEANING

A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power ventilators.
   1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
   2. Review data in maintenance manuals. Refer to Division 01 Section "Closeout Procedures" or "Operations and Maintenance Data."
   3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 23 0838

SECTION 23 0840

AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Single-duct air terminal units.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Include a schedule showing unique model designation, model number, size, left or right-hand casing configuration for piping connections and controls access.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Ceiling suspension assembly members.
   2. Size and location of initial access modules for acoustical tile.
   3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Closeout Procedures or Operation and Maintenance Data," include the following:
   1. Instructions for calibrating air flow volumes.

1.3 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

1.4 COORDINATION

A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, HVAC and plumbing system piping, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHUTOFF SINGLE-DUCT AIR TERMINAL UNITS

A. Manufacturers:
1. Environmental Technologies, Inc.; Enviro-Air Div.
2. Price Industries.
3. Titus.
4. Trane.

B. Configuration: Volume-damper assembly inside unit casing with control components located inside a protective metal shroud.

C. Casing: 22-gauge galvanized steel.
1. Casing Lining: Adhesive attached, 3/8-inch- thick, closed cell foam insulation complying with UL 181 erosion requirements and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Access: Removable panels for access to hot water coil or electric heating element, adjustment, or maintenance; with airtight gasket.

D. Volume Damper: Galvanized steel with peripheral gasket, self-lubricating bearings, cast in damper position indicator and mechanical stop to prevent over stroking.
1. Maximum Damper Leakage: ARI 880 rated, 1 percent of nominal airflow at 4-inch wg inlet static pressure.
2. Damper Position: See Control Sequence on Drawings.

E. Attenuator Section: 22-gauge galvanized steel.
1. Lining: Same as box casing lining above.

F. Electric Heating Coil: Slip-in-type, open-coil design with integral control box factory wired and installed. Include the following features:
1. Automatic-reset primary and manual-reset secondary overtemperature protection.
2. Nickel chrome 80/20 heating elements.
3. Airflow switch (differential pressure).
4. Door interlock disconnect switch.
5. Fuses (for coils more than 48 A).
6. Magnetic contactor for each step of control.

G. DDC Controls: Single-package unitary controller and actuator specified in Division 23 Section "HVAC Instrumentation and Controls."
1. The air terminal units shall be equipped with pressure independent direct digital controls supplied by the control contractor and factory mounted by the terminal unit manufacturer. Control contractor shall provide data sheets on all components to be mounted, indicating component dimensions, mounting hardware, and methods, as well as wiring and piping diagrams for each application identified by unit tag per schedule in the drawings to the terminal manufacturer. Control Contractor shall be responsible for cost to ship controls to terminal unit manufacturer’s factory.
2. Controls shall be compatible with pneumatic inlet velocity sensors supplied by the terminal manufacturer. The sensor shall be multi-port center averaging type, with a minimum of four measuring ports, in series are not acceptable. The sensor must provide a minimum differential pressure signal of 0.03" wg. at an inlet velocity of 500 fpm.
3. Controls shall be field set by control contractor for the scheduled minimum and maximum flow rates. Flow measuring taps and flow curves will be supplied with each terminal for field

balancing airflow. All pneumatic tubing shall be UL listed fire retardant (FR) type. Each terminal shall be equipped with labeling showing unit location, size, and scheduled cfm.

4. Terminal manufacturer to provide a Class 2, 24-volt control transformer and disconnect switch.
5. All controls shall be installed in approved NEMA type sheet metal enclosure provided by terminal manufacturer.
6. Control enclosure and wiring shall meet UL listing and labeling requirements of the Local Building Official.
7. If controls are field mounted, air terminal manufacturer shall provide a UL labeled control enclosure and additionally provide disconnect switch and control transformer for air terminals with a fan or electric heat.

2.3 SOURCE QUALITY CONTROL

A. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

B. Verification of Performance: Rate air terminal units according to ARI 880.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

3.2 CONNECTIONS

A. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."

B. Ground units with electric heating coils according to Division 26.

C. Connect wiring according to Division 26 Section.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Complete installation and startup checks according to manufacturer's written instructions and do the following:
1. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
2. Verify that controls and control enclosure are accessible.
3. Verify that control connections are complete.
4. Verify that nameplate and identification tag are visible.
5. Verify that controls respond to inputs as specified.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units. Refer to Division 01 Section "Closeout Procedures or Demonstration and Training."

END OF SECTION 23 0840

SECTION 23 0855

AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Diffusers.

B. Registers / Grilles.

C. Weather Louvers.

1.2 SUBMITTALS

A. Submit under provisions of Section 230010.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.3 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 062 and ASHRAE 70.

B. Test and rate louver performance in accordance with AMCA 500.

PART 2 - PRODUCTS

2.1 GRILLES, REGISTERS AND DIFFUSERS - GENERAL

A. Acceptable Manufacturer's:
1. Titus.
2. Metal Air.
3. Kreuger.
4. Carnes.
5. Price.
6. Tuttle & Bailey.

B. Coordinate / verify border and frame types for ceiling air devices are shown on Architectural Reflective Ceiling Plan.

C. Equip all ceiling mounted air devices with ceiling radiation dampers and thermal blankets.

2.2 SQUARE PLAQUE CEILING DIFFUSERS (ACD)

A. Manufacturer's:
1. Titus Model OMNI: Steel construction.

B. Type: Square plaque stamped diffuser to discharge air in 360 pattern as scheduled with round neck.

C. Neck sizes as shown on drawings, held in place by four hooks; foil backed insulation.

D. Fabrication: Steel with baked white anodic acrylic paint finish.

E. Accessories: Manual damper.

2.3 LINEAR SLOT DIFFUSER (LSD)

A. Manufacturer:
1. Titus, Model TBDI-80.

B. Type: Continuous, 1-inch-wide slot, number of slots wide as scheduled, with adjustable vanes for left, right or vertical discharge; integral ceiling fire damper.

C. Fabrication: Steel with factory baked enamel finish. Exposed surfaces black. T-bar white.

D. Plenum: Integral, galvanized steel, insulated.

E. Accessories: T-bar one side with mounting clip-on opposite side.

2.4 WALL SUPPLY REGISTERS (SR)

A. Manufacturers:
1. Titus Model 300F.

B. Type: Individually adjustable blades, 3/4-inch minimum depth, 3/4-inch maximum spacing with friction pivots to set blades, vertical face, double deflection.

C. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

D. Fabrication: Aluminum with factory white baked anodic acrylic paint finish.

E. Damper: Integral, gang-operated opposed blade type operable from face.

2.5 CEILING EGGCRATE EXHAUST, RETURN AND TRANSFER REGISTERS/GRILLES (E,R,T)

A. Manufacturers:
1. Titus Model 50F.

B. Type: Fixed grilles of 1/2 x 1/2-inch eggcrate.

C. Border:
1. Neck sizes up to 12x12 inch, 1-1/4 inch margin with countersunk screw mounting, with plaster frame.
2. Neck size 14x14 inch and larger, lay in frame.

D. Fabrication: All aluminum with factory white anodic acrylic finish. Provide steel border when scheduled to be equipped with ceiling radiation damper.

E. Damper: Integral, gang-operated, opposed blade type operable from face. Omit damper on transfer grilles (T) and non-ducted return grilles.

2.6 WEATHER LOUVERS

A. Weather Louvers specified under Division 08.

B. Manufacturers:
1. Greenheck Model ESD-603.
2. Other acceptable manufacturers offering equivalent products.
   a. Ruskin.
   b. Airolite.
   c. Construction Specialties.

C. Type: 6 inch deep with stationary blades on 45-degree slope with integral gutter on each jamb shall incorporate an integral downspout, heavy channel frame.

D. Fabrication: 12-gauge thick extruded aluminum, welded assembly, with factory 3 coat Kynar 500 fluoropolymer spray finish, factory standard color to be selected.

E. Mounting: Furnish with exterior masonry strap anchors for installation.

F. Accessories: Removable, rear mounted, 1/2" mesh aluminum birdscreen; extended sill finished to match louver.

G. Performance: 4'x4' unit: Free area = 8.53 sq.ft. (53%); at an intake 1,250 FPM free area velocity static pressure drop not exceeding 0.26" water gauge and water penetration not exceeding 0.01 ounces of water per sq.ft.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlet and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangements.

C. Install diffusers to ductwork with airtight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 099100.

F. Ceiling mounted air devices connected with flexible duct shall be secured to prevent falling if grid shifts.

G. Weather Louvers: Blank unused portion of louvers with sandwich of 1 inch duct liner with 26-gauge galvanized steel inner and outer panels. Fasten blanks to indoor side of louvers with sheet metal screws and seal with duct sealer.

END OF SECTION 23 0855

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SECTION 23 0900

HVAC INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

1.2 DEFINITIONS

A. DDC: Direct digital control.

B. I/O: Input/output.

C. MS/TP: Master slave/token passing.

D. PC: Personal computer.

E. PID: Proportional plus integral plus derivative.

F. RTD: Resistance temperature detector.

1.3 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:
   1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
   2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
   3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
   4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
   5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
   6. Program Execution Frequency: Run capability of applications as often as five seconds but selected consistent with mechanical process under control.
   7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
   8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
      a. Water Temperature: Plus or minus 1 deg F.
      b. Water Flow: Plus or minus 5 percent of full scale.
      c. Water Pressure: Plus or minus 2 percent of full scale.
      d. Space Temperature: Plus or minus 1 deg F.
      e. Ducted Air Temperature: Plus or minus 1 deg F.
      f. Outside Air Temperature: Plus or minus 2 deg F.
      g. Dew Point Temperature: Plus or minus 3 deg F.
      h. Temperature Differential: Plus or minus 0.25 deg F.
      i. Relative Humidity: Plus or minus 5 percent.
      j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
      k. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
      l. Airflow (Terminal): Plus or minus 10 percent of full scale.

m. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
n. Carbon Monoxide: Plus or minus 5 percent of reading.
o. Carbon Dioxide: Plus or minus 50 ppm.
p. Electrical: Plus or minus 5 percent of reading.

1.4 SEQUENCE OF OPERATION

A. Control diagrams on drawings are intended to indicate, in general, control arrangements. Provide all instruments, relays, operators, switches, etc. required to accomplish control sequences whether or not such devices are actually shown on control diagrams.

1.5 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
3. Wiring Diagrams: Power, signal, and control wiring.
4. Details of control panel faces, including controls, instruments, and labeling.
5. Written description of sequence of operation.
6. Schedule of dampers including size, leakage, and flow characteristics.
7. Schedule of valves including flow characteristics.
8. DDC System Hardware:
a. Wiring diagrams for control units with termination numbers.
b. Schematic diagrams and drawings for field sensors and control hardware.
c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
10. Controlled Systems:
a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
c. Written description of sequence of operation including schematic diagram.
d. Points list.

C. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.

D. Samples for Initial Selection: For each color required, of each type of thermostat or sensor cover with factory-applied color finishes.

E. Samples for Verification: For each color required, of each type of thermostat or sensor cover.

F. Software and Firmware Operational Documentation: Include the following:
1. Software operating and upgrade manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.
5. Software license required by and installed for DDC workstations and control systems.

G. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.

H. Qualification Data: For installer.

I. Field quality-control test reports.

J. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
5. Calibration records and list of set points.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with ASHRAE 135 for DDC system components.

1.7 DELIVERY, STORAGE, AND HANDLING

A. System Software: Update to latest version of software at Project completion.

1.8 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with drawings and room details before installation.

B. Coordinate equipment with Division 28 Section "Intrusion Detection" to achieve compatibility with equipment that interfaces with that system and with building master clock.

C. Coordinate equipment with Division 28 Section "Security Access" to achieve compatibility with equipment that interfaces with that system.

D. Coordinate equipment with Division 28 Section "Clock and Program Control" to achieve compatibility with equipment that interfaces with that system.

E. Coordinate equipment with Division 28 Section "Detention Monitoring and Control (PLC Based)" to achieve compatibility with equipment that interfaces with that system.

F. Coordinate equipment with Division 28 Section "Lighting Controls" to achieve compatibility with equipment that interfaces with that system.

G. Coordinate equipment with Division 28 Section "Fire Alarm" to achieve compatibility with equipment that interfaces with that system.

H. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.

I. Coordinate equipment with Division 26 Section "Electrical Power Monitoring and Control" to achieve compatibility of communication interfaces.

J. Coordinate equipment with Division 26 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.

K. Coordinate equipment with Division 26 Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

L. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Replacement Materials: One replacement diaphragm or relay mechanism for each unique positioning relay.
   2. Maintenance Materials: One thermostat adjusting key(s).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to, manufacturers specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CONTROL SYSTEM

A. Available Manufacturers:
   1. Trane; Worldwide Applied Systems Group
   2. Automated Logic Corporation.
   3. Honeywell International Inc.; Home & Building Control.
   4. Johnson Controls, Inc.; Controls Group.
   5. KMC Controls/Kreuter Manufacturing Company.
   6. Siemens Building Technologies, Inc.
   7. STC Worldwide.

B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

C. Control system shall include the following:
1. Building intrusion detection system specified in Division 28 Section "Intrusion Detection."
2. Building clock control system specified in Division 28 Section "Clock and Program Control."
3. Building lighting control system specified in Division 28 Section "Lighting Controls."
4. Fire alarm system specified in Division 28 Section "Fire Alarm."

2.3 DDC EQUIPMENT

A. Operator Workstation: One PC-based microcomputer(s) with minimum configuration as follows:
1. Motherboard: With 8 integrated USB 2.0 ports, integrated Intel Pro 10/100 (Ethernet), integrated audio, bios, and hardware monitoring.
2. Processor: Intel Pentium 11
3. Random-Access Memory: 64 GB.
4. Graphics: Video adapter, minimum 1600 x 1200 pixels, 64 MB video memory, with TV out.
5. Monitor: 24 inches, LCD color.
6. Keyboard: QWERTY, 105 keys in ergonomic shape.
7. Hard-Disk Drive: 500 GB .
8. Mouse: Three button, optical.
9. Uninterruptible Power Supply: 350 kVa.
10. Operating System: Microsoft Windows 10 with high-speed Internet access.
    a. ASHRAE 135 Compliance: Workstation shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
11. Printer: Color, ink-jet type as follows:
    a. Print Head: 4800 x 1200 dpi optimized color resolution.
    b. Paper Handling: Minimum of 100sheets.
    c. Print Speed: Minimum of 17ppm in black and 12ppm in color.
12. Application Software:
    a. I/O capability from operator station.
    b. System security for each operator via software password and access levels.
    c. Automatic system diagnostics; monitor system and report failures.
    d. Database creation and support.
    e. Automatic and manual database save and restore.
    f. Dynamic color graphic displays with up to 10 screen displays at once.
    g. Custom graphics generation and graphics library of HVAC equipment and symbols.
    h. Alarm processing, messages, and reactions.
    i. Trend logs retrievable in spreadsheets and database programs.
    j. Alarm and event processing.
    k. Object and property status and control.
    l. Automatic restart of field equipment on restoration of power.
    m. Data collection, reports, and logs. Include standard reports for the following:
        1) Current values of all objects.
        2) Current alarm summary.
        3) Disabled objects.
        4) Alarm lockout objects.
        5) Logs.
    n. Custom report development.
    o. Utility and weather reports.
    p. ASHRAE Guideline 3 report.
    q. Workstation application editors for controllers and schedules.
    r. Maintenance management.

13. Custom Application Software:
    a. English language oriented.
    b. Full-screen character editor/programming environment.
    c. Allow development of independently executing program modules with debugging/simulation capability.
    d. Support conditional statements.
    e. Support floating-point arithmetic with mathematical functions.
    f. Contains predefined time variables.

B. Diagnostic Terminal Unit: Portable notebook-style, PC-based microcomputer terminal capable of accessing system data by connecting to system network with minimum configuration as follows:
1. System: With one integrated USB 2.0 port, integrated Intel Pro 10/100 (Ethernet), integrated audio, bios, and hardware monitoring.
2. Processor: Intel Pentium 11
3. Random-Access Memory: 64GB.
4. Graphics: Video adapter, minimum 1024 x 768 pixels, 64 MB video memory.
5. Monitor: 17 inches, LCD color.
6. Keyboard: QWERTY 105 keys in ergonomic shape.
7. Hard-Disk Drive: 500 GB.
8. Pointing Device: Touch pad or other internal device.

C. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
    a. Global communications.
    b. Discrete/digital, analog, and pulse I/O.
    c. Monitoring, controlling, or addressing data points.
    d. Software applications, scheduling, and alarm processing.
    e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
3. Standard Application Programs:
    a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, anti-short cycling, PID control, DDC with fine tuning, and trend logging.
    b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
    c. Chiller Control Programs: Control function of condenser-water reset, chilled-water reset, and equipment sequencing.
    d. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
    e. Remote communications.
    f. Maintenance management.
    g. Units of Measure: Inch-pound and SI (metric).
4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.

5. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

D. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
   a. Global communications.
   b. Discrete/digital, analog, and pulse I/O.
   c. Monitoring, controlling, or addressing data points.
3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

E. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
7. Universal I/Os: Provide software selectable binary or analog outputs.

F. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

G. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
1. Minimum dielectric strength of 1000 V.
2. Maximum response time of 10 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.4 UNITARY CONTROLLERS

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.

1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.
3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.
4. Indoor enclosure: Dustproof rated for operation at 32 to 120 deg F.
5. Outdoor enclosure: Waterproof rated for operation at 40 to 150 deg F.

2.5 ALARM PANELS

A. Unitized cabinet with suitable brackets for wall or floor mounting. Fabricate of 0.06-inch- thick furniture-quality steel or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish. Provide common keying for all panels.

B. Indicating light for each alarm point, single horn, acknowledge switch, and test switch, mounted on hinged cover.
1. Alarm Condition: Indicating light flashes and horn sounds.
2. Acknowledge Switch: Horn is silent and indicating light is steady.
3. Second Alarm: Horn sounds and indicating light is steady.
4. Alarm Condition Cleared: System is reset and indicating light is extinguished.
5. Contacts in alarm panel allow remote monitoring by independent alarm company.

2.6 ANALOG CONTROLLERS

A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.

B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F, and single- or double-pole contacts.

C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.

D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

E. Receiver Controllers: Single- or multiple-input models with control-point adjustment, direct or reverse acting with mechanical set-point adjustment with locking device, proportional band adjustment, authority adjustment, and proportional control mode.
1. Remote-control-point adjustment shall be plus or minus 20 percent of sensor span, input signal of 3 to 13 psig.
2. Proportional band shall extend from 2 to 20 percent for 5 psig.
3. Authority shall be 20 to 200 percent.

4. Air-supply pressure of 18 psig, input signal of 3 to 15 psig, and output signal of zero to supply pressure.
5. Gages: 3-1/2 inches in diameter, 2.5 percent wide-scale accuracy, and range to match transmitter input or output pressure.

2.7 TIME CLOCKS

A. Available Manufacturers:
1. ATC-Diversified Electronics.
2. Grasslin Controls Corporation.
3. Paragon Electric Co., Inc.
4. Precision Multiple Controls, Inc.
5. SSAC Inc.; ABB USA.
6. TCS/Basys Controls.
7. Theben AG - Lumilite Control Technology, Inc.
8. Time Mark Corporation.

B. Solid-state, programmable time control with 4 separate programs each with up to 100 on-off operations; 1-second resolution; lithium battery backup; keyboard interface and manual override; individual on-off-auto switches for each program; 365-day calendar with 20 programmable holidays; choice of fail-safe operation for each program; system fault alarm; and communications package allowing networking of time controls and programming from PC.

2.8 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Thermistor Temperature Sensors and Transmitters:
1. Available Manufacturers:
   a. BEC Controls Corporation.
   b. Ebtron, Inc.
   c. Heat-Timer Corporation.
   d. I.T.M. Instruments Inc.
   e. MAMAC Systems, Inc.
   f. RDF Corporation.
2. Accuracy: Plus or minus 0.5 deg F at calibration point.
3. Wire: Twisted, shielded-pair cable.
4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
5. Averaging Elements in Ducts: 36 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft.
6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

C. RTDs and Transmitters:
1. Accuracy: Plus or minus 0.2 percent at calibration point.
2. Wire: Twisted, shielded-pair cable.
3. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.

4. Averaging Elements in Ducts: 18 inches long, rigid; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
5. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
6. Room Sensor Cover Construction: Manufacturer's standard locking covers.
7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
8. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

D. Humidity Sensors: Bulk polymer sensor element.
1. Accuracy: 2 percent full range with linear output.
2. Room Sensor Range: 20 to 80 percent relative humidity.
3. Room Sensor Cover Construction: Manufacturer's standard locking covers.
4. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
5. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of minus 22 to plus 185 deg F.
6. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

E. Pressure Transmitters/Transducers:
1. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
b. Output: 4 to 20 mA.
c. Building Static-Pressure Range: 0- to 0.25-inch wg.
d. Duct Static-Pressure Range: 0- to 5-inch wg.
2. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
3. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.
4. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
5. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.

F. Room Sensor Cover Construction: Manufacturer's standard locking covers.

G. Room sensor accessories include the following:
1. Insulating Bases: For sensors located on exterior walls.
2. Guards: Locking; heavy-duty, transparent plastic; mounted on separate base
3. Adjusting Key: As required for calibration and cover screws.

2.9 STATUS SENSORS

A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.

B. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

C. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.

D. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage, and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.

E. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.

F. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

2.10 GAS DETECTION EQUIPMENT

A. Available Manufacturers:
1. B. W. Technologies.
2. CEA Instruments, Inc.
3. Ebtron, Inc.
4. Gems Sensors Inc.
5. Greystone Energy Systems Inc.
6. Honeywell International Inc.; Home & Building Control.
7. INTEC Controls, Inc.
8. I.T.M. Instruments Inc.

B. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment; for flush mounting.

2.11 FLOW MEASURING STATIONS

A. Duct Airflow Station: Combination of air straightener and multiport, self-averaging pitot tube station.
1. Available Manufacturers:
   a. Air Monitor Corporation.
   b. Ebtron.
2. Casing: Galvanized steel frame.
3. Flow Straightener: Aluminum honeycomb, 3/4-inch parallel cell, 3 inches deep.
4. Sensing Manifold: Copper manifold with bullet-nosed static pressure sensors positioned on equal area basis.

2.12 THERMOSTATS

A. Combination Thermostat and Fan Switches: Line-voltage thermostat with push-button or lever-operated fan switch.
1. Label switches “FAN ON-OFF".
2. Mount on single electric switch box.

B. Electric, solid-state, microcomputer-based room thermostat with remote sensor.
1. Automatic switching from heating to cooling.
2. Preferential rate control to minimize overshoot and deviation from set point.
3. Set up for four separate temperatures per day.
4. Instant override of set point for continuous or timed period from 1 hour to 31 days.
5. Short-cycle protection.
6. Programming based on weekday, Saturday, and Sunday.
7. Selection features include degree F or degree C display, 12- or 24-hour clock, keyboard disable, remote sensor, and fan on-auto.
8. Battery replacement without program loss.
9. Thermostat display features include the following:
   a. Time of day.
   b. Actual room temperature.
   c. Programmed temperature.

d. Programmed time.
e. Duration of timed override.
f. Day of week.
g. System mode indications include "heating," "off," "fan auto," and "fan on."

C. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.

D. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.
1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
2. Selector Switch: Integral, manual on-off-auto.

E. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.
1. Bulbs in water lines with separate wells of same material as bulb.
2. Bulbs in air ducts with flanges and shields.
3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.
4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.
6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.

F. Fire-Protection Thermostats: Listed and labeled by an NRTL acceptable to authorities having jurisdiction; with fixed or adjustable settings to operate at not less than 75 deg F above normal maximum operating temperature, and the following:
1. Reset: Manual.

G. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.

H. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.

I. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.
1. Bulb Length: Minimum 20 feet.
2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

J. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above set point.
1. Bulb Length: Minimum 20 feet.
2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

K. Heating/Cooling Valve-Top Thermostats: Proportional acting for proportional flow, with molded-rubber diaphragm, remote-bulb liquid-filled element, direct and reverse acting at minimum shutoff pressure of 25 psig and cast housing with position indicator and adjusting knob.

2.13 HUMIDISTATS

A. Duct-Mounting Humidistats: Electric insertion, 2-position type with adjustable, 2 percent throttling range, 20 to 80 percent operating range, and single- or double-pole contacts.

2.14 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
   1. Comply with requirements in Division 23 Section "Motors."
   2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
   3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
   4. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
   5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
   6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
   1. Valves: Size for torque required for valve close off at maximum pump differential pressure.
   2. Dampers: Size for running torque calculated as follows:
      a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
      b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
      c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft of damper.
      d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
      e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
      f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
   3. Coupling: V-bolt and V-shaped, toothed cradle.
   4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
   5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
   6. Power Requirements (Two-Position Spring Return): 24-V ac.
   7. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
   8. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
   9. Temperature Rating: Minus 22 to plus 122 deg F.
   10. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
   11. Run Time: 12 seconds open, 5 seconds closed.

2.15 DAMPERS

A. Dampers: AMCA-rated, opposed-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades

shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.

1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

2.16 CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring are specified in Division 26 Section "Voice and Data Communication Cabling."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that power supply is available to control units and operator workstation.

3.2 INSTALLATION

A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above the floor.
   1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

D. Install guards on thermostats in the following locations:
   1. Entrances.
   2. Public areas.
   3. Where indicated.

E. Install automatic dampers according to Division 23 Section "Duct Accessories."

F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

G. Install labels and nameplates to identify control components according to Division 23 Section "Mechanical Identification."

H. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."

I. Install refrigerant instrument wells, valves, and other accessories according to Division 23 Section "Refrigerant Piping."

J. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.

K. Install electronic and fiber-optic cables according to Division 26 Section "Voice and Data Communication Cabling."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
   2. Test and adjust controls and safeties.
   3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
   4. Test each point through its full operating range to verify that safety and operating control set points are as required.
   5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
   6. Test each system for compliance with sequence of operation.
   7. Test software and hardware interlocks.

C. DDC Verification:
   1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
   2. Check instruments for proper location and accessibility.
   3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
   4. Check instrument tubing for proper fittings, slope, material, and support.
   5. Check installation of air supply for each instrument.
   6. Check flow instruments. Inspect tag number and line and bore size and verify that inlet side is identified and that meters are installed correctly.
   7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
   8. Check temperature instruments and material and length of sensing elements.
   9. Check control valves. Verify that they are in correct direction.
   10. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
   11. Check DDC system as follows:
      a. Verify that DDC controller power supply is from emergency power supply, if applicable.
      b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
      c. Verify that spare I/O capacity has been provided.
      d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.4 ADJUSTING

A. Calibrating and Adjusting:
   1. Calibrate instruments.
   2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
   3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
   4. Control System Inputs and Outputs:
      a. Check analog inputs at 0, 50, and 100 percent of span.

b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
c. Check digital inputs using jumper wire.
d. Check digital outputs using ohmmeter to test for contact making or breaking.
e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.

5. Flow:
   a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
   b. Manually operate flow switches to verify that they make or break contact.
6. Pressure:
   a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
   b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
7. Temperature:
   a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
   b. Calibrate temperature switches to make or break contacts.
8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 23 0900

SECTION 23 0950

TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1. SUMMARY

A. This Section includes TAB to produce design objectives for the following:
   1. Air Systems.
   2. Duct leakage tests.
   3. Hydronic Piping Systems.
   4. HVAC equipment quantitative-performance settings.
   5. Duct mounted smoke detectors.
   6. Verifying that automatic control devices are functioning properly.
   7. Reporting results of activities and procedures specified in this Section.

1.2. DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.

D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

E. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

F. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

G. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

H. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

I. TAB: Testing, adjusting, and balancing.

J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

1.3. SUBMITTALS

A. Qualification Data: Submit evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article and below.

B. Sample Report Forms: Submit sample TAB report forms.

C. Certified TAB Reports: Submit three copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

1.4. QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.

B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
   1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
   2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use TAB firm's forms approved by Architect.

D. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

E. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
   1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.5. PROJECT CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.6. COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

D. Coordinate all TAB work through the contract schedule. Certified TAB reports are required one month prior to Substantial Completion to allow thorough review. The Certified TAB report must be approved by the Owner, Engineer and Commissioning Firm (if applicable) before the project can receive Substantial Completion.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine approved submittal data of HVAC systems and equipment.

B. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

C. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

D. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

E. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.

F. Examine plenum ceilings used for return air to verify that they are airtight with no openings to the exterior.

G. Examine strainers for clean screens and proper perforations.

H. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

I. Examine equipment for installation and for properly operating safety interlocks and controls.

J. Examine automatic temperature system components to verify the following:
   1. Dampers, valves, and other controlled devices are operated by the intended controller.
   2. Dampers and valves are in the position indicated by the controller.
   3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multi-zone units, mixing boxes, and variable-air-volume terminals.
   4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
   5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
   6. Sensors are located to sense only the intended conditions.
   7. Sequence of operation for control modes is according to the Contract Documents.
   8. Controller set points are set at indicated values.
   9. Interlocked systems are operating.
   10. Changeover from heating to cooling mode occurs according to indicated values.

K. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.3 PROCEDURES FOR DUCTWORK LEAKAGE TESTING

A. Scope and Leakage Rate: Refer to Division 23 Section “Metal Ducts, Part 3, Article “Field Quality Control” for extent of ductwork to be tested and allowable leakage rates.

B. Prior to testing, submit drawings indicating sections of ductwork to be tested, including duct surface area and allowable leakage (CFM) calculations.

C. Leakage testing shall be performed in accordance with ASHRAE/SMACNA Standard 126 “Method of Testing HVAC Air Ducts and Fittings” except as noted otherwise on drawings or specifications.

D. Submit a report certifying ductwork testing and results.

E. Ductwork failing test shall be reconstructed and retested until satisfactory.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Verify that motor starters are equipped with properly sized thermal protection.

E. Check dampers for proper position to achieve desired airflow path.

F. Check for airflow blockages.

G. Check for proper sealing of air-handling unit components.

H. Check for proper sealing of air duct system.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure fan static pressures to determine actual static pressure as follows:
      a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
      b. Measure static pressure directly at the fan outlet or through the flexible connection.
      c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
      d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
   2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
      a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
   3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, under final balanced conditions.
   4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Recommend corrective action to align design and actual conditions.
   5. Make required adjustments to pulley sizes to accommodate fan-speed changes.
   6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
   1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
      a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Re-measure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure terminal outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set outside-air dampers at minimum and return- and exhaust-air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
    a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
6. Re-measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
7. Measure static pressure at the most critical terminal unit and coordinate with control contractor to adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record the final fan performance data.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
   1. Open all manual valves for maximum flow.
   2. Check makeup-water-station pressure gage for adequate pressure (min. 5 psig) for highest vent.
   3. Check flow-control valves for specified sequence of operation and set at indicated flow.
   4. Set system controls so automatic valves are wide open to heat exchangers.
   5. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.

3.8 PROCEDURES FOR HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures:
   1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
   2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
   3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
   4. Report flow rates that are not within plus or minus 5 percent of design.

B. Set calibrated balancing valves, if installed, at calculated presettings.

C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
   1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
   1. Determine the balancing station with the highest percentage over indicated flow.
   2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
   3. Record settings and mark balancing devices.

F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

B. Compensating for Diversity: When the total water flow of all terminal units is more than the indicated water flow of the pump, place a selected number of terminal units at a minimum set-point water flow condition until the total water flow of the terminal units equals the indicated water flow of the pump. Select the reduced water flow terminal units so they are distributed evenly among the branch pipes.

C. Measure differential static pressure at the most critical terminal unit or air handler and coordinate with controls contractor to adjust the differential pressure controller, at the main differential sensor/transmitter, to ensure that adequate differential pressure is maintained at the most critical unit.

D. Record the final pump performance data.

3.10 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.11 PROCEDURES FOR CHILLERS

A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:
1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
2. If water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.

3.12 PROCEDURES FOR HEAT-TRANSFER COILS

A. Water Coils: Measure the following data for each coil:
1. Water flow rate.
2. Water pressure drop.
3. Airflow.
4. Air pressure drop.

B. Electric-Heating Coils: Measure the following data for each coil:
1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.

C. Refrigerant Coils: Measure the following data for each coil:
1. Airflow.
2. Air pressure drop.

3.13 PROCEDURES FOR DUCT MOUNTED SMOKE DETECTORS TESTING

A. All duct smoke detectors shall be tested to ensure that the devices properly sample the air stream.

B. The tests shall be made in accordance with the smoke detector manufacturer’s requirements and instructions.

C. Provide testing documentation so that it can be included with the Closeout Documents for the fire alarm system.

3.14 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

G. Check the interaction of electrically operated switch transducers.

H. Check the interaction of interlock and lockout systems.

I. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or non-grounded power supply.

J. Note operation of electric actuators using spring return for proper fail-safe operations.

3.15 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 10 to minus 10 percent.
2. Air Outlets and Inlets: Plus 10 to minus 10 percent.
3. Cooling-Water Flow Rate: Plus 10 to minus 10 percent.

3.16 REPORTING

A. Status Reports: As Work progresses, prepare reports to describe deficiencies and problems found in systems being tested and balanced.

3.17 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, bound, tabulated, and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed by the certified testing and balancing Agent.
1. Include a list of instruments used for procedures, along with proof of calibration.

C. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
1. Title page.
2. Name and address of TAB firm.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB firm who certifies the report.
10. Table of Contents.

11. Summary of contents including the following:
    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer, type, and size.
14. Notes to explain why certain final data in the body of reports varies from indicated values.
15. Test conditions for fans and pump performance forms including the following:
    a. Settings for outside-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Face and bypass damper settings at coils.
    d. Fan drive settings including settings and percentage of maximum pitch diameter.
    e. Settings for supply-air, static-pressure controller.
    f. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outside, supply, return, and exhaust airflows.
2. Terminal units.
3. Balancing stations.

E. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data: Include the following:
    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Sheave make, size in inches, and bore.
    g. Sheave dimensions, center-to-center, and amount of adjustments in inches.
    h. Number of belts, make, and size.
    i. Number of filters, type, and size.
2. Motor Data:
    a. Make and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
3. Test Data (Indicated and Actual Values):
    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Filter static-pressure differential in inches wg.
    f. Preheat coil static-pressure differential in inches wg.
    g. Cooling coil static-pressure differential in inches wg.
    h. Heating coil static-pressure differential in inches wg.
    i. Outside airflow in cfm.
    j. Return airflow in cfm.

F. Apparatus-Coil Test Reports:
   1. Coil Data:
      a. System identification.
      b. Location.
      c. Coil type.
   2. Test Data (Indicated and Actual Values):
      a. Airflow rate in cfm.
      b. Air pressure drop in inches wg.
      c. Return-air, wet- and dry-bulb temperatures in deg F.
      d. Entering-air, wet- and dry-bulb temperatures in deg F.
      e. Leaving-air, wet- and dry-bulb temperatures in deg F.
      f. Water flow rate in gpm.
      g. Water pressure differential in feet of head or psig.
      h. Entering-water temperature in deg F.
      i. Leaving-water temperature in deg F.

G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
   1. Unit Data:
      a. System identification.
      b. Location.
      c. Coil identification.
   2. Test Data (Indicated and Actual Values):
      a. Airflow rate in cfm.
      b. Entering-air temperature in deg F.
      c. Leaving-air temperature in deg F.
      d. Voltage at each connection.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
   1. Fan Data:
      a. System identification.
      b. Location.
   2. Motor Data:
      a. Make and frame type and size.
      b. Horsepower and rpm.
      c. Volts, phase, and hertz.
      d. Full-load amperage and service factor.
      e. Sheave make, size in inches, and bore.
      f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
      g. Number of belts, make, and size.
   3. Test Data (Indicated and Actual Values):
      a. Total airflow rate in cfm.
      b. Total system static pressure in inches wg.
      c. Fan rpm.
      d. Discharge static pressure in inches wg.
      e. Suction static pressure in inches wg.

I. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
   1. Report Data:
      a. System and air-handling unit number.

b. Location and zone.
c. Duct static pressure in inches wg.
d. Duct size in inches.
e. Duct area in sq. ft.
f. Indicated airflow rate in cfm.
g. Indicated velocity in fpm.
h. Actual airflow rate in cfm.
i. Actual average velocity in fpm.

J. Air-Terminal-Device Reports:
1. Unit Data:
a. System and air-handling unit identification.
b. Location.
c. Air-terminal-device number from system diagram.
d. Air-terminal-device type and model number.
e. Air-terminal-device size.
f. Air-terminal-device effective area in sq. ft.
2. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm.
b. Preliminary airflow rate as needed in cfm.
c. Final airflow rate in cfm.

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data:
a. System and air-handling unit identification.
b. Location and zone.
c. Room or riser served.
d. Flowmeter type.
2. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

L. Packaged Chiller Reports:
1. Unit Data:
a. Unit identification.
b. Make and model number.
2. Water-Cooled Condenser Test Data (Indicated and Actual Values):
a. Entering water temperature in deg F.
b. Leaving water temperature in deg F.
c. Entering water pressure in feet of head or psig.
d. Water pressure differential in feet of head or psig.
3. Evaporator Test Reports (Indicated and Actual Values):
a. Entering water temperature in deg F.
b. Leaving water temperature in deg F.
c. Entering water pressure in feet of head or psig.
d. Water pressure differential in feet of head or psig.

M. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
   1. Unit Data:
      a. Unit identification.
      b. Location.
      c. Service.
      d. Make and size.
      e. Model and serial numbers.
      f. Water flow rate in gpm.
      g. Water pressure differential in feet of head or psig.
      h. Required net positive suction head in feet of head or psig.
      i. Pump rpm.
      j. Impeller diameter in inches.
      k. Motor make and frame size.
      l. Motor horsepower and rpm.
      m. Voltage at each connection.
      n. Amperage for each phase.
      o. Full-load amperage and service factor.
      p. Seal type.
   2. Test Data (Indicated and Actual Values):
      a. Static head in feet of head or psig.
      b. Pump shutoff pressure in feet of head or psig.
      c. Actual impeller size in inches.
      d. Full-open flow rate in gpm.
      e. Full-open pressure in feet of head or psig.
      f. Final discharge pressure in feet of head or psig.
      g. Final suction pressure in feet of head or psig.
      h. Final total pressure in feet of head or psig.
      i. Final water flow rate in gpm.
      j. Voltage at each connection.
      k. Amperage for each phase.

N. Instrument Calibration Reports:
   1. Report Data:
      a. Instrument type and make.
      b. Serial number.
      c. Application.
      d. Dates of calibration.

3.18 INSPECTIONS

A. Before final acceptance of the Tab Report:
   1. Owner or Architect shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
   2. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
   3. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

4. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
5. Request a second final inspection.

END OF SECTION 23 0950

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SECTION 23 2113

HYDRONIC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and pipe fittings for:
   1. Chilled water piping.
   2. Equipment drains and overflows piping.
   3. Pre-insulated and factory cladded piping.
   4. Welded branch and tap connections.
   5. Pipe hangers and supports.
   6. Joining materials.
   7. Unions, flanges, and couplings.
   8. Dielectric fittings.
   9. Transition fittings.

B. Valves:
   1. Gate valves.
   2. Globe or angle valves.
   3. Ball valves.
   4. Below grade ball valves.
   5. Plug valves.
   6. Butterfly valves.
   7. Check valves.

C. Water treatment for closed loop systems:
   1. HVAC water treatment equipment.
   2. HVAC Water filtration equipment.
   3. HVAC water treatment chemicals.

1.2 RELATED SECTIONS

A. Section 230062 “Hangers and Supports for HVAC Piping and Equipment” for pipe and equipment supports.

B. Section 230900 “HVAC Instrumentation and Controls” for Automatic Temperature-Control Valves and Actuators.

C. Section 312000 “Earth Moving” for excavating, trenching, and backfilling.

1.3 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified for an application, Contractor may use any of the listed pipe materials for that application.

B. Where more than one piping system material is applied, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

C. Use unions, flanges, and couplings at control valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to control valves, equipment, or other apparatus.

D. Use non-conducting dielectric connections whenever joining dissimilar metals.

E. Provide pipe hangers and supports in accordance with ASTM B31.9 unless indicated otherwise.

F. Use spring loaded check valves on discharge of pumps.

G. Use lug end butterfly valves to isolate equipment for pipe size NPS 2-1/2 and larger.

H. Use NPS ¾ ball valves with hose end connection and cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

1.4 ACTION SUBMITTALS

A. Product Data for each of the following
   1. Pipe material, pipe fittings, valves, and accessories.
   2. Chemical treatment for closed loop systems.

B. Welders certificates.

C. Anchors for Underground Piping: Concrete pipe anchor sizes and steel reinforcement bars for underground heating water pipes. Calculations shall be signed and sealed by a Professional Engineer registered in the State where project is located.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
   3. Welder's Certificate: Provide certificate of compliance indicating approval of welders prior to any welding. Certificate must be obtained from an independent certification agency, dated within the past 12 months, and must include welders I.D. Number. Test must be for 6G position, E-6010 root and E-7018 filler. Provide photo identification (Driver’s License). Welder must stamp each weld with his I.D.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping" for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.

E. HVAC Water-Treatment Service Provider Qualifications:
   1. An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.
   2. Have a certified “In-House” laboratory capable of performing all analysis required with water system.
   3. Water treatment work shall be supplied by a single provider.

1.7 PERFORMANCE REQUIREMENTS FOR HVAC WATER TREATMENT

A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.

B. Base HVAC water treatment on quality of water available at project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

C. Closed hydronic systems, including chilled water, shall have the following water qualities:
1. pH: Maintain a value within 9.0 to 10.5.
2. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
3. Boron: Maintain a value within 100 to 200 ppm.
4. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
5. Soluble Copper: Maintain a maximum value of 0.20 ppm.
6. TDS: Maintain a maximum value of 10 ppm.
7. Ammonia: Maintain a maximum value of 20 ppm.
8. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
9. Microbiological Limits:
   a. Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
   b. Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
   c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
   d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
   e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

PART 2 - PRODUCTS

2.1 CHILLED WATER PIPING, BURIED

A. Pre-Insulated Pipe: See Pre-Insulated Piping System article below.

B. Steel Pipe: ASTM A53, Schedule 40, 0.375-inch wall sizes for NPS 12 and over, black.
1. Fittings: ASTM A234, forged steel welding type.
2. Joints: AWS D1.1, welded.
3. Casing: Closed glass cell insulation with Pittwrap jacketing.

2.2 CHILLED WATER PIPING, ABOVE GROUND

A. Steel Pipe: ASTM A53 / A53M, Schedule 40, 0.375-inch wall sizes for NPS 12 and over, black, with plain ends.
1. Fittings: ASTM B16.39, malleable iron threaded or ASTM A234 / A234M wrought steel welded. Wall thickness to match adjoining pipe.
2. Joints: NPS 2-1/2 and smaller to be threaded; NPS 3 and larger to be AWS D1.1 welded.
3. Pipe Nipples: Pipe nipples to be Schedule 40 stainless steel.

B. Copper Tubing: ASTM B88, Type L, drawn temper.
1. Fittings: ASME B16.22, wrought copper.
2. Joints: NPS 4 and smaller, Solder. NPS 6 and larger, Brazed.

2.3 EQUIPMENT DRAINS AND OVERFLOWS PIPING

A. Copper Tubing: ASTM B88, Type L, drawn temper.
1. Fittings: ASME B16.22, wrought copper.
2. Joints: NPS 4 and smaller, Solder. NPS 6 and larger, Brazed.

2.4 PRE-INSULATED AND FACTORY CLADDED PIPING SYSTEMS

A. Manufacturers:
1. Basis of Design:
   a. Chilled Water: Thermacor Process, Inc.: Model Ferro-Therm.
   b. Non-Potable Water: Thermacor Process, Inc.: Model Copper-Therm.

2. Insul-Pipe System, Inc.
3. Perma-Pipe, Inc.
4. Ravanco Piping Systems, Inc.
5. Thermal Pipe Systems, LP.

B. Furnish a complete HDPE jacketed system of factory pre-insulated (insulation not required for cladded only systems) piping for the specified service. All pre-insulated pipe, fittings, insulating materials, and technical support shall be provided by the pre-insulated piping system manufacturer.

C. A complete layout of the system, showing anchors, expansion provisions, and building entrance details, shall be provided by the pre-insulated pipe manufacturer.

D. Carrier Pipe:
1. Chilled Water Pipe: Carrier pipe shall be steel ASTM A-53, Grade B., ERW (Type E) or seamless (Type S), standard weight for sizes NPS 2 and larger and shall be ASTM A-106/A-53, standard weight for sizes NPS 1-1/2 and smaller. All carbon steel pipe shall have ends cut square and beveled for butt-welding, except sizes smaller than 2-inch shall be socket-welded. Straight sections of factory insulated pipe shall have 6-inches of exposed pipe at each end for field joint fabrication.
2. Non-Potable Water: Carrier shall be Type K Drawn-Temper Copper tube, conforming to ASTM B-88. All copper piping shall have ends cut square for socket brazing. Straight sections of factory insulated pipe shall have 6-inches of exposed pipe at each end for field joint fabrication. Field joining of piping shall utilize approved methods of brazing with alloys melting at or above 1100°F.

E. Insulation: Polyurethane foam insulation shall be sprayed or injected with one shot into the annular space between carrier pipe and jacket with a minimum thickness as scheduled on chart below. Insulation shall be rigid, 90% closed cell polyurethane with a minimum 2.0 pounds per cubic foot density, compressive strength of 30 psig, and coefficient of thermal conductivity (K-Factor) not higher than 0.18 at 75 deg F per ASTM C-518. Maximum allowable operating temperature shall not be less than 250 deg F.

MINIMUM INSULATION THICKNESS	
Pipe size	Insulation Thickness
NPS 1/2	2.15-inches
NPS 3/4	2.04-inches
NPS 1	1.91-inches
NPS 1-1/4	1.74-inches
NPS 1-1/2	1.62-inches
NPS 2	1.38-inches
NPS 2-1/2	1.77-inches
NPS 3	1.46-inches
NPS 4	1.96-inches

F. Jacketing: Jacketing material shall be extruded, black, high-density polyethylene (HDPE), having a minimum wall thickness of 125 mils for jacket sizes less than or equal to 12-inches, 150 mils for

jacket sizes 12- to 20-inches, and 175 mils for jacket sizes greater than 20-inches. Provide a secure bond between the jacket and foam insulation/pipe preventing any ingression of water at the jacket/ foam interface.

G. Straight run field joints shall be field insulated per the manufacturer's instructions, using polyurethane foam poured in an HDPE sleeve and sealed with heat shrink tape. All joint closures and insulation shall occur at straight sections of pipe. All insulation and jacketing materials shall be furnished by pre-insulated piping system manufacturer.

H. Fittings are factory prefabricated and pre-insulated (insulation not required for jacketed only pipe systems) with polyurethane foam to the thickness specified and jacketed with a one-piece seamless molded HDPE fitting cover, a butt fusion welded, or an extrusion welded and mitered HDPE jacket. Carrier pipe fittings shall be butt-welded, except sizes smaller than 2" shall be socket-welded. Fittings include expansion loops, elbows, tees, reducers, and anchors. Elbows, loops, offsets, or any other direction changes for steel pipe shall conform to the standards set by ASME B31.1, Code for Power Piping.

2.5 WELDED BRANCH AND TAP CONNECTIONS

A. No mitering or notching for fittings allowed. Weldolets or threadolets may be used in lieu of the fittings where branch size is 2 pipe sizes smaller than main unless fittings are noted on the drawings. Forged steel half couplings may be used for drain, vent, and gauge connections.

2.6 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports in accordance with Section 230062 "Hangers and Supports for HVAC Piping and Equipment."

2.7 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos free, spiral wound 1/8-inch maximum thickness unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 150, cast-iron and cast-bronze flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.8 UNIONS, FLANGES AND COUPLINGS

A. Unions for Pipe NPS 2 and Under:
   1. Steel Piping: ASME B16.39, 150 psig malleable-iron, threaded.
   2. Copper Pipe: Wrought-copper unions, ASME B16.22, soldered.

B. Flanges for Pipe NPS 2-1/2 and Above:
   1. Steel Piping: Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
      a. Material Group: 1.1.
      b. End Connections: Butt welding.

2. Copper Pipe: Bronze.
3. Pipe Flange Gasket Materials: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.
    a. ASME B16.21, nonmetallic, flat, asbestos free, spiral wound 1/8-inch maximum thickness unless thickness or specific material is indicated.
    b. Full-Face Type: For flat-face, Class 150, cast-iron and cast-bronze flanges.
4. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Steel Pipe Nipples: ASTM A733, same wall thicknesses as pipe in which they are installed.

2.9 DIELECTRIC FITTINGS

A. Dielectric Nipples:
1. Manufacturers:
    a. Jones Stephens Corp., Series D006-753 through D006-700.
    b. Grinnell Mechanical Products.
    c. Perfection Corp.
    d. Precision Plumbing Products, Inc.
    e. Sioux Chief Manufacturing Co., Inc.
    f. Victaulic Co. of America; Clearflow Dielectric Waterway Style 47.
2. Description:
    a. Standard: IAPMO PS 66.
    b. Electroplated steel nipple. complying with ASTM F 1545.
    c. Pressure Rating: 300 psig at 225 deg F.
    d. End Connections: Male threaded.
    e. Lining: Inert and noncorrosive, propylene

B. Dielectric Flanges:
1. Manufacturers:
    a. Capital Manufacturing.
    b. Central Plastics.
    c. Watts.
    d. Wilkins, a Zurn Company.
2. Description:
    a. Standard: ASSE 1079.
    b. Factory-fabricated, bolted, companion-flange assembly.
    c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

C. Dielectric Flange Insulating Kits:
1. Non-conducting materials for field assembly or companion flanges.
2. Pressure Rating: 150 psig.
3. Gasket: Neoprene or phenolic.
4. Bolt Insulation Sleeves: Phenolic or polyethylene.
5. Washers: Phenolic with steel backing washers

2.10 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:
1. For pipe sizes NPS 2 and smaller: PVC or CPVC, Schedule 80, one-piece fitting; one end with threaded brass insert, and one solvent-cement socket or threaded end.
2. For pipe sizes larger than NPS 2: Flanged joints, provide ductile iron back up flange for plastic pipe.

B. Fitting-Type Transition Couplings:
1. Manufactured piping coupling or specified piping system fitting.

C. HDPE-to-Steel Transition Fittings:
1. For all pipe sizes: Provide HDPE flanged adaptor, with ductile iron back-up ring.

2.11 GATE VALVES

A. Up to and Including Pipe Size NPS 2:
1. Class 125, RS bronze gate valves:
a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron

B. Pipe Size NPS 2-1/2 and Over:
1. Class 150, OS&Y steel gate valves:
a. Standard: MSS SP-70, Type I.
b. NPS 2-1/2 to NPS 14, CWP Rating: 300 psig.
c. Body Material: ASTM A 216 grade WCB, cast steel bolted bonnet.
d. Ends: Flanged.
e. Trim: API Trim 8 with Stellite 6 faced carbon steel seat.
f. Disc: Flexible wedge, ASTM A 217 – CA 15.
g. Packing and Gasket: Asbestos free, spiral wound.
h. Stem: ASTM 276-410 stainless steel.

2.12 GLOBE OR ANGLE VALVES

A. Up to and Including 2 Inches:
1. Class 150, bronze globe valves, and bronze disc:
a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union bonnet.
d. Ends: Threaded.
e. Stem: Bronze, replaceable seat. Rising stem.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron.

B. Over 2 Inches:
1. Class 150, OS&Y iron globe valves
a. Standard: MSS SP-85, Type I.
b. CWP Rating: 300 psig.
c. Body Material: ASTM A 216, grade WCB cast steel with bolted bonnet.
d. Ends: Flanged.
e. Trim: API Trim 8 with Stellite 6 faced carbon steel seat.
f. Disc: ASTM A217-CA15.
g. Stem: ASTM A2776-410 stainless steel.
h. Packing and Gasket: Asbestos free, spiral wound.

2.13 BALL VALVES

A. For Chilled Water Up to and Including pipe size NPS 2:
   1. Manufactures:
      a. Apollo with Therma-Seal insulating tee handle.
      b. Kitz with ISE (insulated stem extension).
      c. Nibco T585-70-66-NS NIB-Seal.
      d. Nexus: (with insulated valve stem) approved for use in conditioned spaces only; field insulate top of valve stem.
   2. Two-piece, full port vented ball with bronze or forged bronze body, blowout proof stem, ASTM A276, Type 316 stainless steel ball, stem, and handle nut; reinforced PTFE packing, thrust washer and seat ring, lever handle with balancing memory stops, solder, or threaded ends. Pressure/temperature to match service requirements, but no less than 250 psig at 250-degree F, SW. 600 psig, CWP. Insulated valve handle extension to clear insulation.

2.14 PLUG VALVES

A. Up to and Including 2 Inches:
   1. Bronze body, bronze tapered plug, full port opening, non-lubricated, Teflon packing, threaded ends.
   2. Operator: One plug valve wrench for every ten plug valves minimum of one.

B. Over 2 Inches:
   1. Cast iron body and plug, full port opening, pressure lubricated, Teflon packing, flanged ends.
   2. Operator: Each plug valve with a wrench with set screw.

2.15 BUTTERFLY VALVES – RESILIENT SEATED

A. Manufacturers: Subject to compliance with specifications as noted herein, provide products by one of the following:
   1. ABZ Valve Model 397.
   2. Centerline Model A2-021-05.
   3. Demco Model NE-C.
   4. Kitz Model 6122E or 6123E.
   5. Mueller Model 88.

B. Standard: MSS-67, Type 1.

C. Body: Class 150 ductile iron, lug pattern, extended neck design to allow for 2” minimum insulation.

D. Liner/Seat: Valves shall be provided with molded-in EPDM liner, bonded and fused to the valve body and hard backed cartridge seat. Liner shall be non-collapsible and stretch resistant to eliminate failure in either pressure or vacuum service, in a design that eliminates possible leakage between body and liner. Valves shall provide full rated dead-end service from 150 pisg to vacuum to 28-inches mercury without the need for a flange on the downstream side.

E. Disc Material: Aluminum bronze.

F. Stem: 410 or 416 stainless steel in order to eliminate leak paths and possible turbulence in flow, stem shall have molded O-ring seals and shall be of the snap ring encapsulated, blowout proof design. Stem to disc engagement shall be of the internally driven design to provide rigid connection between components and eliminate failure under high vibration service. Stem to disc connection via pins, bolts or any external device shall be unacceptable.

G. Packing: EDPM V-type packing shall be utilized in a packing retention design that allows for self-adjustment of packing, eliminate stem leakage and protect around the stem area.

H. Shut Off: Valves shall be certified bubble tight and shall be rated as follows:
1. Valves pipe size NPS 2 to 12 shall be rated to a minimum 200 psi shut off/dead end service.
2. Valves pipe size NPS 14 to 36 shall be rated to a minimum 150 psi shut off/dead end service.

I. Operator: Infinite position locking lever handle shall be provided on valves NPS 4 and smaller. On valves NPS 6 and larger, a worm-gear drive with handwheel shall be included with visual position indicator (MDPI) and shall provide for a positive stop on input shaft to allow for balancing of flow.

J. Valves shall be suitable for 250º F hydronic service.

2.16 BALL VALVES – DIRECT BURIAL

A. Manufacturers: Subject to compliance with Specifications as noted herein, provide product by one of the following:
1. Flowserve Corporation.
2. Vexve Armatury Group

B. Description: Completely insulated and jacketed long-stem, reduced bore ball valves for direct bury application.
1. Body:
a. DN 25–500 Steel, P235GH (1.0345).
b. DN 600–800 Steel, P355 NL1 (1.0566)/ GP240GH (1.0619).
2. Ball:
a. DN 25–600 Stainless steel, X5CrNi18-10 (1.4301).
b. DN 700–800 Steel + stainless plating, ASTM A350 LF2+Ni.
3. Stem: Stainless steel, X8CrNiS18-9 (1.4305).
4. Top of stem: Stainless steel, X5CrNi18-10 (1.4301).
5. Stem seals: FPM.
6. Ball seals: PTFE+C.
7. Equipment: unpainted.
8. Operation: equipped with angle gear, standard hexagon adapter.

C. Insulated and jacketed by Underground Piping System manufacturer.
1. Insulation shall be foam polyurethane or polyisocyanurate and outer jacketing shall be High Density Polyethylene (HDPE).

D. Valve Operator: Angle gear on top, operated with extended T-Key

E. Comply with AWWA M44 for cast iron valve boxes. Include top section, telescopic adjustable extension of length required for depth of burial vale, plug with lettering “CHW” approximately 5-inches in diameter and bottom section with base that fits over valve with barrel.

F. Operating wrenches: Steel, tee handle with one pointed end and socket to match valve operating nut. Length as required to reach deepest buried valve.

2.17 SWING CHECK VALVES

A. Up to and Including NPS 2:
1. Manufactures:
a. Grinnell: Model 3600.
b. Crane.
c. Milvco.
2. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, spring loaded threaded ends, 125 psig WIG.

B. NPS 2 and Larger:

1. Iron body cast steel with bolted cap, bronze trim, bronze, or bronze faced rotating swing disc, renewable disc and seat, flanged ends.
2. Check valve in chilled water decoupler line between the primary and secondary piping loops, to have external indicator.

2.18 AUTOMATIC TEMPERATURE CONTROL VALVES, ACTUATORS, AND SENSORS

A. Comply with requirements specified in Section 230900 "HVAC Instrumentation and Controls."

2.19 WATER TREATMENT FOR CLOSED LOOP SYSTEMS

A. Manufacturers:
1. Chem-Aqua
2. Garratt Callahan
3. Guardian – IPCO, Inc.
4. Nalco Company
5. Triple Point

B. Combination Bypass Feeder and Filter Bag:
1. Manufacturers: Subject to compliance with requirements, provide product by one of the following:
   a. Neptune FTF-5HP with legs and filter bags
2. Steel, with corrosion-resistant exterior coating, minimum 3-1/2-inch (89-mm) fill opening in the top, and NPS 3/4 (DN 20) bottom inlet and top side outlet. Quarter turn or threaded fill cap with gasket seal and diaphragm to lock the top on the feeder when exposed to system pressure in the vessel.
3. Capacity: 7.5 gal.
4. Minimum Working Pressure: 125 psig.
5. 5-micron cleanable bag filter.

C. Water Meter:
1. Manufacturers: Subject to compliance with requirements, provide product by one of the following:
   a. Hersey Measurement Company.
   b. Neptune Technology Group: Model T-10.
2. Description: Nutating disc, positive displacement water meter.
   a. Housing: Corrosion-resistant, no-lead high copper alloy.
   b. Register: Magnetic, low torque, impact.
   c. Connections: Threaded.
3. Size: 5/8", unless noted otherwise in Drawings.

D. Chemicals: Specially formulated, based on analysis of makeup water, to prevent bacteria growth and the accumulation of scale and corrosion in piping and connected equipment.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination or Shop Drawings.

B. Select system components with pressure rating equal to or greater than system operating pressure.

C. Remove scale and dirt on inside and outside before assembly.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. Route piping in orderly manner, parallel to building structure, and maintain gradient.

F. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

G. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

H. Install piping to conserve building space and not interfere with use of space.

I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

J. Install piping to permit valve servicing.

K. Group piping whenever practical at common elevations.

L. Slope piping at indicated slopes and arrange to drain at low points.

M. Install piping free of sags and bends.

N. Install drains, consisting of a tee fitting, NPS ¾ ball valve, and hose end connection with cap, at low points in piping system mains and elsewhere as required for system drainage.

O. Install fittings for changes in direction and branch connections. No mitering or notching for fittings permitted, except as noted below:
   1. Steel Butt Welded Pipe:
      a. For changes in direction of 15 degrees or less, pipe may be mitered.
      b. For change in direction greater than 15 degrees, standard elbow shall be cut to form the required odd angle elbow.
   2. Steel Pipe Branch Connections for Hydronic Piping:
      a. Branch NPS 4 and smaller and at least two pipe sizes smaller than the main, weldolets, threadolets, and sockolets are allowed.
      b. Branch NPS 6 and larger and at least two pipe sizes smaller than the main, sweepolets are allowed.

P. Reduce pipe sizes using eccentric reducer fitting installed with flat side up.

Q. Install piping to allow application of insulation.

R. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

S. Provide access doors where valves and fittings are not exposed. Comply with requirements for building access doors specified in Section 230053 “Basic HVAC Materials and Methods.”

T. Install unions in piping, NPS 2 and smaller, adjacent to automatic valves, pressure reducing valves, at final connections of equipment, and elsewhere as indicated.

U. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

V. Install sleeves for piping penetrations of walls, ceilings, and floors as specified in Section 230053 “Basic HVAC Materials and Methods.”

W. Install escutcheons for piping penetrations of walls, ceilings, and floors in exposed finished spaces. Comply with requirements for escutcheons specified in Section 230053 “Basic HVAC Materials and Methods.”

X. Identify piping as specified in Section 230077 “Identification for HVAC Piping and Equipment.”

Y. Install air vents at all high points in piping, at heat-transfer coils, and elsewhere as required for system air venting as specified in Section 232114 "Hydronic Specialties."

Z. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welds.

AA. Prepare and paint uninsulated pipe, fittings, supports, and accessories, ready for finish painting. Refer to Division 09 Sections "Interior Painting" and "Exterior Painting" for requirements.

3.2 INSTALLATION – UNDERGROUND PRE-INSULATED AND CLADDED PIPING SYSTEMS

A. Underground systems shall be buried in a trench not less than three feet deeper than the top of the pipe. A minimum thickness of 24-inches compacted backfill placed over the top of the pipe.

B. Comply with requirements of Section 312000 "Earth Moving"" and other Division 31 site construction Sections and trench details on Civil Drawings.

C. Trench bottom shall have a minimum of 6-inches of sand. All field cutting of the pipe shall be performed in accordance with the manufacturer's installation instructions.

D. The interior of all pipe, fittings, valves, and accessories shall be kept free from dirt and foreign material. Suitable bulkheads shall be used to block or plug ends of piping at the close of each workday and when work on a particular section of the piping is temporarily discontinued. Should dirt, mud, concrete, or other foreign materials be allowed to enter the piping, such piping shall immediately be cleaned.

E. Each length or section of pipe shall be cleaned immediately before being placed in the trench and joined. Cleaning shall be accomplished by using a tight swab or other suitable cleaning device. Pipe ends shall be wiped clean immediately before the pipe is joined.

F. A hydrostatic pressure test of the carrier pipe shall be performed at one-half times the normal system operating pressure for not less than two hours.

G. Underground piping, joints, and fittings shall not be insulated prior to hydrostatic, or leak testing, of piping system and inspection by Owner's Representative.

H. Underground joints and fittings shall not be backfilled prior to pressure test on closure system and inspection by Owner's Representative.

I. Field Service shall be provided by a certified manufacturer's representative or company field service technician. The technician will be available at the job for a minimum of one day (or more if required by job size) to check unloading, storing, and handling of pipe, pipe installation, pressure testing, field joint insulation, and backfilling techniques.

3.3 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Section 230062 "Hangers for HVAC Piping and Equipment."

B. Pipe Hanger Spacing pipe hanger spacing and hanger rod sizing requirements are specified in Section 230062 "Hangers for HVAC Piping and Equipment."

C. For insulated piping, provide insulation inserts and shields as specified in Section 230712 "HVAC Systems Insulation."

D. For insulated, strut-mounted copper pipe (NPS 1/4 to 4), provide Insulation Couplings per the requirements of Section 230062 "Hangers and Supports for HVAC Piping and Equipment."

E. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

F. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

G. Flanged Joints:
   1. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
   2. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing in wet piping systems. **Do not use dielectric unions**.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.

C. Dielectric Fittings for NPS 2-1/2 and Larger: Use dielectric flange kits.

3.6 VALVE APPLICATIONS

A. Install shutoff-duty valves at supply and return connections to each piece of equipment and elsewhere as indicated.

B. Install check valves at each pump discharge and elsewhere as required to control flow direction.

C. If valve applications are not indicated on the Drawings, use the following:
   1. Shutoff Service: Ball, butterfly valves.
   2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
   3. Throttling Service: Globe, ball, or butterfly valves.
   4. Pump-Discharge Check Valves:
      a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
      b. NPS 2-1/2 and Larger: Iron swing check valves with spring or iron, center-guided, resilient-seat check valves.

D. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Pipe outlet without valves to the drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

E. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, adjacent to each valve control valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

B. Wet Piping Systems: Install dielectric fittings to connect piping materials of dissimilar metals.

C. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

D. Install control valves in accessible locations close to connected equipment.

E. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Section 230122 "Meters and Gages."

3.8 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe, not inverted.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for butterfly, gate, globe, and plug valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 80 inches above finished floor.

F. Install check valves for proper direction of flow and as follows:
   1. Swing Check Valves: In horizontal position with hinge pin level.
   2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.

3.9 INSTALLATION – DIRECT BURIAL BALL VALVES

A. Install valves per manufacturer's instructions.

3.10 PIPE CLEANING AND FLUSHING

A. Keep pipe clean and free of dirt. Keep caps on ends of pipe, or covered with 6-mil plastic, when it is stored on site and reinstall caps on ends of installed piping at the end of each day.

B. On bench work making up fittings and when installing fittings, wipe slag out of ends of pipe where accessible from the open end.

C. Tap and bump long pieces of pipe to knock loose welding slag inside pipe out of the open end.

D. Prior to closing up piping system, piping shall be flushed, blown, or pigged as necessary to provide clean systems.

E. Underground Piping System – Additional Requirements:
   1. Contractor to submit a piping cleaning plan, process, and schedule for cleaning the underground piping system.
      a. Coordinate flushing and cleaning process with Commissioning Authority.
   2. Contractor to provide temporary pipe, fitting and pumps as required.
   3. Pump circulation rate (gpm) to be as recommended by Chemical Treatment Supplier.

4. Pipes shall be flushed to low points.

F. When flushing and cleaning the pipe, provide a bypass at coils (air handlers, fan coil units, air terminal units, etc.) and heat exchangers (includes brazed, shell-in-tube or plate and frame heat exchangers at packaged air-cooled chillers and self-contained water-cooled AC unit, etc.) with full size hoses or PVC pipe until cleaning process is complete.

G. Complete flush and cleaning of piping system as directed by chemical treatment and Commissioning Agent technician, being certain to keep strainers clean and removing start-up strainers at pumps after pipe cleaning is complete.

H. When connecting new pipe to existing system, provide temporary pump, piping, valves, cartridge filter (5 microns), and one-shot chemical feeder. New piping system to be flushed, cleaned, and treated prior to opening to existing piping system.

3.11 FIELD QUALITY CONTROL

A. Leave joints, including welds, uninsulated and exposed for examination during test.

B. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
4. Isolate expansion tanks and determine that hydronic system is full of water.
5. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
6. Duration: 6 hours without evidence of leakage.
7. Correct or replace defective workmanship or materials shown by tests and retest as necessary to insure tightness.
8. Prepare written report of testing.

C. Perform the following before operating the system:
1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.

3.12 WATER TREATMENT FOR ALL CLOSED LOOP SYSTEMS

A. General:
1. Water treatment chemical supplier for thermal water piping systems shall work with the Contractor to ensure that all thermal water piping and HVAC systems are properly flushed, cleaned, and passivated.
2. Install water meter in the make-up water line serving each closed loop piping system.
3. After completion of installation and leak test, fill, clean/flush and treat system.
4. Prepare, and submit for approval, pipe flushing, cleaning and treatment plan. Commissioning Authority shall approve plan and witness process.

B. Pipe Cleaning:
   1. Install combination bypass filter and chemical feeder in a bypass circuit around the circulation pumps, unless otherwise indicated on the Drawings.
   2. Coordinate with Mechanical Contractor to provide required bypass piping, valves, etc. prior to flushing and cleaning of piping systems.
      a. Provide bypass piping around all coils and control valves prior to fill and flush operation.
      b. Provide spool pieces in place of all inline flow meters during testing, cleaning, and flushing operations.
   3. Start pipe cleaning process with 50-micron filters and move down to 25-micron filters as system is cleaned. Final filters shall be 5-micron.
   4. Provide temporary crossovers and temporary pumps as required for cleaning new work before valves at connections to existing work are opened. Minimum cleaning flow rates to provide water velocity of 4 feet per second.

Minimum Cleaning Water Flows	
Pipe Size (NPS)	Flow (GPM)
4	150

C. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling.

D. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

E. After initial flushing and cleaning, open coils up to system, complete cleaning, and addition of biocide.

F. Underground Piping System – Additional Requirements:
   1. Pipe shall be flushed and treated no more than one week after initial cleaning.

G. Water treatment provider shall provide a minimum of twice weekly service and analysis during the first two weeks after start-up and a minimum of monthly service for the first year after Substantial Completion. Service visits to include chemical analysis of closed loop systems, adjusting chemistry as required and changing dirty cartridge filters and blowing down the air dirt separator. Provide Owner with written report of findings and/or actions taken during the monthly service visits.
   1. Initial blow downs of air/dirt separator to be into a barrel until most of the dirt/trash are removed. (Do not pour dirt down the floor drain.)

END OF SECTION 23 2113

SECTION 23 2114

HYDRONIC SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Expansion tanks.

B. Air control devices.

C. Air and dirt separators.

D. Strainers.

E. Pump suction fittings.

F. Venturi flow meter.

G. Hose kits.

H. Relief valves.

I. Flexible connections.

J. Venturi balancing valve.

1.2 RELATED SECTIONS

A. Section 230900 “HVAC Instrumentation and Controls” for Automatic Temperature-Control Valves and Actuators.

1.3 DEFINITIONS

A. Branch Line: As related to the requirements for installing automatic versus manual air vents, a branch line is any runout that services only one terminal unit.

1.4 ACTION SUBMITTALS

A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model, and dimensions.

1.5 INFORMATIONAL SUBMITTALS

A. Operation and Maintenance Data: For air control devices and hydronic specialties, s to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 BLADDER-TYPE EXPANSION TANKS

A. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Armstrong.

2. Bell & Gossett.
3. Elbi of America.
4. Taco.
5. Wheatley.

B. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory tested, precharge with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

C. Bladder: flexible heavy-duty butyl bladder (removable). Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.

D. Steel support stand for floor mounted units.

E. Accessories: Air-charging fitting; precharge to 12 psig.

F. Automatic Cold-Water Fill Assembly: Pressure reducing valve, check valve, strainer, and valved bypass.
1. Pressure reducing valve adjustment range to be as required to obtain scheduled expansion tank pressure.

2.2 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide one of the following:
1. Armstrong.
2. Elbi of America.
3. Hoffman Model 79.
4. Watson-McDaniel.
5. Wheatley.

B. Manual Air Vents:
1. Body: Bronze.
2. Internal Parts: Stainless Steel Ball.
3. Operator: Lever.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 15- psig.
7. Maximum Operating Temperature: 225 deg F.

C. Automatic Float Type:
1. Body: cast iron.
2. Internal Parts: Stainless Steel.
3. Operator: Stainless Steel metal float.
4. Inlet Connection: NPS ½ with ball valve.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 150-psig.
7. Maximum Operating Temperature: 240 deg F.

2.3 AIR AND DIRT- TYPE SEPARATOR

A. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Armstrong: DAS-R and DASH-R.
2. Bell & Gossett: CRS.
3. Elbi of America.

4. Spirotherm: Dirt and Drain.
5. Taco.
6. Thrush: Aar-O-Vent.
7. Wessels: Series Wess-Vent.

B. Description: In-line coalescing type air and dirt separator with removable head.
1. Shell: Carbon steel with exterior red oxide primer finish.
a. Inlet and Outlet Connections: Threaded for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger.
b. Tank: Flanged; ASME constructed and labeled for 150-psig minimum working pressure and 375 deg F maximum operating temperature.
c. Coalescence Media: Integral 304 stainless steel or copper bundle of spiral wound tubes, constructed to direct released air into expansion tank and collect dirt.
2. Blow down connection with bronze ball valve with stainless steel ball and shaft.
3. Skim/flush connection with bronze ball valve with stainless steel ball and shaft.
4. High capacity, float actuated air vent with ball valve isolation valve.
5. Inlet and outlet gauge ports.

C. Rating: Remove 99% of dissolved oxygen and 96% of dirt particles 5-microns and larger.

D. Sizing: Air and dirt separator shall be sized per manufacturer's recommendations. Maximum pressure drop for sizes 2-inch to 12-inch shall not exceed two feet of water for standard velocity units and three feet of water for high velocity units.

2.4 STRAINERS

A. Body 2-inch and smaller:
1. Screwed brass or iron body by 175 psig working pressure, Y pattern with 1/32-inch stainless steel perforated screen.

B. Size 2-1/2-inch to 4 -inch:
1. Flanged iron body for 175 psig working pressure, Y pattern with 3/64-inch stainless steel perforated screen.

C. Strainer Screen: 40-mesh startup strainer. Liquid service 3-inch and smaller, 20 mesh screen, 4-inch and larger, 3/64-inch diameter.

2.5 PUMP SUCTION FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide one of the following:
1. Armstrong.
2. Aurora.
3. Bell & Gossett.
4. Mueller.
5. Taco Model SD.
6. Wheatley Model FD.

B. Fitting: Angle pattern, cast-iron or ductile body, threaded or flanged for 2-inch and smaller, flanged for 2-1/2-inch and larger, rated for 175-psig working pressure, with bronze or stainless-steel straightening vanes, 304 stainless steel cylinder strainer with 3/16-inch diameter openings, bronze disposable fine mesh start-up strainer to fit over bronze or stainless-steel permanent cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.

C. Accessories: Adjustable foot support, blowdown tapping in bottom, gage tapping inside.

2.6 VENTURI FLOW METER

A. Manufacturers: Subject to compliance with requirements, provide one of the following:
   1. Armstrong.
   2. Flow Design.
   3. Gerand.
   4. Presco.
   5. Taco.

B. Venturi Flow Meter: 150 psig WP. Venturi Flow Meter, bronze, screwed 2-inch and smaller; steel, butt-welded in sizes 2-1/2-inch and larger, 3% accuracy over 10:1 range, maximum line pressure drop not exceeding 1-foot. Provide quick connect 1/8-inch MNPT x ¼-inch brass ball valve process connections with 2.5-inch brass extensions. Provide stainless steel ID tag for each meter indicating manufacturer, model, size, design flow, design differential pressure. Submit meter differential pressure vs flow graph.

C. Portable differential pressure meter consisting of case containing 10-foot color coded hoses for low- and high-pressure connections, and connectors suitable for connection to read-out valves.

2.7 HOSE KITS

A. Manufacturers: Subject to compliance with requirements, provide one of the following:
   1. Flow Design, Inc.
   2. Twin City Hose.
   3. Nexus.

B. Hose:
   1. Inner Hose: Fire retardant thermoplastic tube.
   2. Exterior Sleeve: Stainless steel, braided.
   3. Pressure Rating: 600 psig at 230F.
   4. Length: As required for installation: Minimum 12-inches and maximum 24-inches.
   5. Brass End Fittings:
      a. One end fixed male screw.
      b. One end with swivel female with nipple (MxM).
      c. Inverted flare nipple, “washerless design.”

C. Venturi Balancing Valves – See respective articles, this section.

D. Automatic Valve – see Section 230900 “HVAC Instrumentation and Controls.”

2.8 RELIEF VALVES

A. Bronze body, Silicone seat, stainless steel stem and springs, automatic, direct pressure actuated, capabilities ASME certified and labeled.

2.9 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide one of the following:
   1. Flexonics.
   2. Hypsan.
   3. Keflex.
   4. Southeastern Hose.
   5. Twin City Hose.

B. Laminated 2-ply corrugated 304 stainless steel joints designed for 150 psig WP. Joints shall be flanged and have not less than 5” relaxed face-to-face dimension.

C. For each joint furnish a control unit consisting of tie bolts with required nuts, spacers, washers and stop and lock nuts.

D. All thread rods shall not be used for tie bolts. Nuts and bolts for joints in chilled water lines shall be type 304 stainless steel.

2.10 VENTURI BALANCING VALVE

A. Manufactures: Subject to compliance with requirements, provide one of the following:
1. Flow Design Inc., FlowSet.
   a. Size ½ inch to 2 inch: Model UA-SBS.
   b. Size 2-1/2 inch to 18 inch: Model AF or AW (Model AG (grooved pipe) only allowed when specified under specific piping system).
2. Bell & Gossett.
3. Griswold Controls.
4. Nutech.
5. Nexus.
6. Preso.

B. Design: Manual balancing devices shall be venturi type as defined by ASHRAE. Devices shall have a precision machined throat and have a stated catalog accuracy of 3% full scale. The induced differential reading (flow signal) shall be greater than two feet water column at the design flow with the valve in the wide-open position. The valves are to have differential readout ports fitted with 2" extensions, check valve, and protective cap, and are to have a memory stop to allow complete shut-off and return to set position without losing the setpoint.

C. Construction:
1. All devices, 2" and smaller, shall have a machined brass venturi section and a throttling ball valve with a memory stop on the downstream side of the venture. The ball valve shall have a brass or bronze body, blowout proof stem, type 316 stainless steel ball, stainless steel stem, virgin Teflon seats, brass stem and packing nut and a steel handle.
   a. Thread or sweat connections.
2. Valves 2" and larger, shall have a venturi section and a throttling butterfly valve with a memory stop. Butterfly valve shall meet the specification requirements for ball valves in Section "Hydronic Piping."
   a. Flanged connections.

D. Minimum Ratings:
1. Devices with sweat or NPT connections: 400 PSIG at 250 degrees F.
2. Devices with flanged connections: 200 PSIG at 250 degrees F.

E. Installation:
1. The upstream and downstream straight pipe required to achieve 3% full scale accuracy shall be incorporated as an integral part of the venturi and valve assembly. No additional straight piping shall be required.

F. Accessories:
1. Provide factory fabricated insulation kit with handle cover and accessory extensions.
2. Provide tag attached to each valve with brass or stainless-steel chain indicating the following:
   a. Manufacturer.
   b. Size and model.
   c. Differential pressure at design flow.
3. Submit with flow versus differential pressure drop for each valve size with Closeout Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Air Vents:
   1. In piping mains, provide automatic air vents at piping high points and as indicated on the Drawings.
      a. For automatic air vents, provide 1/4-inch, Type L soft copper vent tubing to nearest drain.
   2. In piping branches and at heat-transfer coils, provide manual air vents at piping high points and as indicated on the Drawings.

C. Air Eliminator and Dirt Separators:
   1. Provide full port stainless-steel ball valves at blow down and flush/skim connections, if not provide with unit.
   2. Pipe blow down and flush/skim valves line size to floor drain.
   3. Pipe air vent outlet with ¼-inch copper tube to floor drain.
   4. Provide inlet and outlet valves to isolate unit, with a line-size, valved bypass around separator.
   5. Install unit to allow sufficient clearance below unit to remove coalescing media when bottom cover is removed.
   6. Upon initial start-up, the blow down and skim valves should be operated frequently.
   7. Provide pressure gauge with valved taps at inlet and outlet pipe.

D. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS ¾ nipple and ball valve with hose end connection in blowdown connection of strainers.

E. Support pump fittings with floor mounted pipe and flange supports.

F. Relief Valves:
   1. Provide relief valves on heat exchangers.
   2. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
   3. Pipe relief valve outlet to nearest floor drain.
   4. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

G. Hose Kits: Install without loops or excess length and so that hose is not under tension or compression forces.

END OF SECTION 23 2114

SECTION 23 3113

METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg. Metal ducts include the following:
   1. Sheet metal materials.
   2. Single-wall rectangular ducts and fittings.
   3. Single-wall round and flat-oval ducts and fittings.
   4. Sealants and gaskets.
   5. Hangers and supports.

1.2 RELATED SECTIONS

A. Section 230553 “Identification for HVAC Piping and Equipment” for labeling requirements for fire dampers, smoke dampers, and duct access doors.

B. Section 230593 “Testing, Adjusting and Balancing” for testing, adjusting, and balancing for metal ducts.

C. Section 230712 “HVAC Systems Insulation” for duct liner requirements.

D. Section 233300 “Duct Accessories” for dampers, sound-control devices, duct-mounted access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:
   1. Sealants and gaskets.

B. Shop Drawings: Drawn to 1/4-inch equals 1-foot scale.
   1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
   2. Factory-and shop-fabricated ducts and fittings.
   3. Duct layout indicating sizes, configuration, liner material, seal classification, and static-pressure classes.
   4. Elevation of bottom of ducts.
   5. Dimensions of main duct runs from building grid lines.
   6. Fittings.
   7. Reinforcement and spacing.

8. Seam and joint construction.
9. Penetrations through smoke barriers and fire-rated construction.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including access doors and dampers.
12. Hangers and supports, including methods for duct and building attachment.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to a scale large enough to indicate and resolve conflicts, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services including:
      a. Suspended ceiling components.
      b. Other systems installed in same space as duct.
      c. Ceiling and wall mounting access doors and panels required to provide access to dampers and other operating devices.
      d. Ceiling mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
   2. Indicate proposed changes to duct layout.
   3. Provide Coordination Drawings for the following areas:
      a. Mechanical Room.

B. BIM: Provide a 3D BIM model to indicate and resolve conflicts in which the following items are shown and coordinated based on input from installers of the items involved:
   1. Duct installation indicating coordination with general construction, building components, and other building services including:
      a. Suspended ceiling components.
      b. Other systems installed in same space as duct.
      c. Ceiling and wall mounting building access doors and panels required to provide access to dampers and other operating devices.
      d. Ceiling mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
   2. Indicate proposed changes to duct layout.

1.6 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections, including pitting, dents and other imperfections including those which would impair post painting.

C. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G90.
   2. Finishes for Surfaces Exposed to View: “Paint Grip” steel - Mill phosphatized or galvanealed.

D. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

E. Stainless Steel: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the Part 3 "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B finish for concealed ducts and No. 4 finish for exposed ducts.

F. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

G. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized where installed on galvanized sheet metal ducts.
   1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

H. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 900 mm 36 inches.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible.”

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible.”

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible.”

E. Duct sizes shown on the Drawings are clear inside dimensions without an allowance for insulation.

2.3 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Eastern Sheetmetal.
   2. Linx Industries, Inc.
   3. McGill AirFlow LLC.
   4. SEMCO Incorporated.
   5. Sheet Metal Connectors, Inc.

6. Spiral Systems., Inc.

C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Transverse Joints in Duct Larger than 60 Inches in Diameter: Flanged.

E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

F. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

G. Fabricate elbows using die-formed, gored, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter unless noted otherwise on drawings. Unless elbow construction type is indicated, fabricate elbows as follows:
1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards-Metal and Flexible," Table 3-1 "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments unless otherwise indicated.
   a. Elbows 12-inches and Smaller in Diameter: Stamped.
   b. Elbows 14-inches and Larger in Diameter: Welded

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, Plus and Minus.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Solvent-Based Joint and Seam Sealant:
1. Application Method: Brush on.

2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L (less water).
10. Maximum Static-Pressure Class: 10-inch wg, Plus and Minus.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant:
1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of0.14 L/s per sq. m at 250 Pa 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, Plus or Minus.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel all-thread rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

3. Supports for Aluminum Ducts: Aluminum, or galvanized steel coated with zinc chromate.

I. Roof Mounted Supports:
1. Duct support systems installed on roof shall be equal to Cooper B-Line: Dura-Block system of plastic bases supports and strut frames.
2. Bases: Injection molded and pressed, plastic and rubber. Bases shall be 18-inch x 18-inch, shop fabricated with inserts for square tubing or threaded rods as required.
3. Framing: 1-5/8-inch or 1-7/8-inch galvanized strut fabricated of steel conforming to ASTM A570, Grade 33. Framing shall be roll formed of 12-gauge steel 3 sided or tubular shaped. Tubing shall be perforated with 9/16-inch holes at 1 7/8-inch centers on 3 sides.
4. Accessories: Provide all clamps, bolts, nuts, washers, and other devices as required for a complete system.
5. Strut Coatings:
   a. Shall be hot dip galvanized. Galvanizing shall conform to ASTM A123 for tubing and ASTM A153 for hardware and accessories, or
   b. High-performance factory applied electro-deposition acrylic coating Unistrut Perma-Green III, electro-deposition epoxy coating Dura Green by Eaton/Cooper B-Line, or approved equivalent.

J. Refer to Section 230529 “Hangers and Supports for HVAC Piping and Equipment,” for additional requirements.

PART 3 - EXECUTION

3.1 DUCT CLEANLINESS

A. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines" and the following:
1. Delivery to Site:
   a. Prevent damage during transportation and off-loading
   b. All duct shall be sealed either by blanking or capping duct ends, bagging small fittings, surface wrapping or shrink wrapping.
2. The area provided for storage shall be clean, dry and exposure to dust minimized. Cover duct stored on construction site with 6 mil plastic.
3. Installation:
   a. Work area shall be clean, dry, and protected from the elements.
   b. Internal surface of uninsulated duct shall be wiped immediately prior to installation.
   c. Open ends on completed work and overnight work-in-progress shall be sealed.
4. Replace internal duct liner that gets wet.

3.2 DUCT INSTALLATION - GENERAL

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts with fewest possible joints.

D. Install factory or shop-fabricated fittings for changes in direction, size, and shape and for connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a minimum clearance of 1-inch, plus allowance for insulation thickness.

H. Route to avoid passing through transformer vaults, electrical equipment rooms and enclosures, data closets, and elevator machine rooms.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Where ducts pass through fire-rated interior partitions and exterior walls or smoke barriers, install fire dampers, smoke dampers or combination fire and smoke dampers as required. Comply with requirements in Section 233300 “Duct Accessories” for fire and smoke dampers.

3.3 EXPOSED DUCTWORK - ADDITIONAL INSTALLATION REQUIREMENTS

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.4 HANGERS AND SUPPORTS INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports.”

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 100 mm4 inches thick.
   4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
   5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1M Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 1200 mm48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports or as shown on the Drawings.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

G. Roof Mounted Duct Support System:
1. Verify that roofing system is complete and that roof surfaces are smooth and flat and are ready to receive work.
2. Verify that roof temperature is a minimum of 60 degrees F for proper adhesive performance.
3. Use care in installation of duct support systems not to damage roofing, flashing, equipment, or related materials.
4. Clean surfaces of roof to receive duct support bases. Remove gravel from gravel surfaced roofs, remove dirt, dust, oils, and other foreign materials from all roofs. Prime existing membrane with a primer that is compatible with existing components in the roofing system.
5. Bases and support framing shall be located as indicated on the drawings and as specified herein. The support of all ductwork shall be complete and adequate, whether or not all required devices are shown.
6. Set bases with adhesive in accordance with manufacturer's installation instructions. Accurately locate and align bases. Where applicable, replace gravel around bases. Install strut framing as required to properly support ductwork.

3.5 CONNECTIONS

A. Make connections to air handlers and fans with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Make connections to air terminal units as shown on the drawings.

C. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in Part 3 "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal Classes:
1. Seal Class A: Seal all transverse joints, longitudinal seams, and duct wall penetrations.
2. Seal Class B: Seal all transverse joints and longitudinal seams.
3. Seal Class C: Seal all transverse joints.

C. All connections shall be sealed under all Seal Classes, including but not limited to spin-ins, taps, other branch connections, access doors, access panels, and duct connections to equipment. Sealing that would void product listings is not required. Spiral lock seams need not be sealed.

D. Seal ducts and perform leak tests (where scheduled in Part 3, Article "Field Quality Control below") prior to concealment of any portion of the duct systems and before external insulation is applied.

E. Spiral Duct Transverse Joints: Joints made with gasketed slip connections meeting leakage Class 4 do not require additional sealing when installed in accordance with the manufacturer's instructions.

3.7 DUCT SCHEDULES

A. Ductwork General: Unless otherwise noted, construct ductwork, fittings, and transitions according to the following schedule:

AIR SYSTEM	MATERIAL	PRESSURE CLASS	SEAL CLASS

Rectangular Supply Duct Before Air Terminal Units	Galvanized	Plus 4-inches wg	A
Round and Flat Oval Supply Duct Before Air Terminal Units	Galvanized Spiral Duct	Plus 4-inches wg	A
Supply Duct After Air Terminal Units	Galvanized	Plus 1-inch wg	C
Low Pressure Supply Ducts	Galvanized	Plus 1-inch wg	C
Return Ducts – Low Pressure	Galvanized	Minus 1-inch wg	C
General Exhaust Ducts	Galvanized	Minus 1-inches wg	C
Transfer Ducts	Galvanized	Minus 1-inch wg	C
Round Supply, Return and General Exhaust Duct – Low Pressure; Size > 14-inch Diameter	Galvanized Spiral Duct	Minus 2-inch to Plus 2-inches wg	C
Round Supply, Return and General Exhaust Duct – Low Pressure; Size ≤ 14-inch Diameter	Galvanized Snap Lock– Min 26 gauge	Minus 1-inch to Plus 1-inch wg	C
Low pressure Supply, OSA Supply, Return and General Exhaust Duct Risers Which Penetrate More Than One Floor	Galvanized	Minus 1-inch to Plus 1-inch wg	B
Notes: 1. Supply duct before the air terminal unit is duct installed between the air handler and the air terminal unit.			

B. Elbow Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
      a. Velocity 1000 fpm or Lower:
         1) Radius Type RE 1 with minimum 0.6 radius-to-diameter ratio.
      b. Velocity 1000 to 1500 fpm:
         1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      c. Velocity 1500 fpm or Higher:
         1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
   2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
      a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered

Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.6 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Welded.

C. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch – Low pressure: Spin in.
c. Rectangular Main to Round Branch – Exceeding 3-inch pressure class: Conical tap.
d. Rectangular Main to Round Branch where main depth is less than 2-inches taller than branch diameter: 45-degree entry with square to round.
e. Provide damper in all low-pressure branch connections.
2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity 1500 fpm or Higher: 45-degree lateral.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections prior to the use or concealment of any portion of a duct system. Ducts shall be considered to be concealed where installed in shafts or covered by coatings or wraps that prevent the ductwork from being visually inspected on all sides.

B. Duct Leakage Tests:
1. Comply with ASHRAE/SMACNA Standard 126 “Method of Testing HVAC Air Ducts and Fittings.” Submit a test report for each test.
2. In paragraphs below specifying which ductwork is to be leak tested, where representative sections to be tested are specified to be only 25-percent of the total duct area installed of the system to be tested, then the following “25-50-100” methodology shall be followed:
a. Should the tested 25-percent fail to meet the requirements of this article, then 50-percent of the total installed duct area shall be tested.
b. Should the tested 50-percent fail to meet the requirements of this article, then 100-percent of the total installed duct area shall be tested.
3. All sections to be tested shall be selected by the building owner or the owner’s representative.
4. Test the following duct systems:
a. Ducts specified to have Class A seal: Test representative duct sections totaling no less than 100-percent of total installed duct area for the designated duct systems.
5. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.
6. No leaks shall be audible.
7. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated on Drawings, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.

8. Positive pressure leakage testing is acceptable for negative pressure ductwork.
9. Maximum allowable leakage (L_{max}) shall be calculated as follows:

$$L_{max} = C_L(P)^{0.65}$$

Where:

L_{max} = maximum permitted leakage in cfm/100 ft^2 duct surface area.

C_L = duct leakage class, cfm/100 ft^2 at one in. wg.

6 for rectangular sheet metal, rectangular fibrous, and round flexible ducts.

3 for round/flat overall sheet metal or fibrous glass ducts.

P = test pressure, which shall be equal to the design duct pressure class rating in inches of wg.

	Leakage Class (C_L) = CFM Leakage per 100 ft^2 @ 1-inch wg		
SEAL CLASS	C	B	A
RECTANGULAR METAL	24	12	6
ROUND METAL	12	6	3

3.9 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Sections 099113 "Exterior Painting" and 099123 "Interior Painting."

3.10 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC.

END OF SECTION 23 3113

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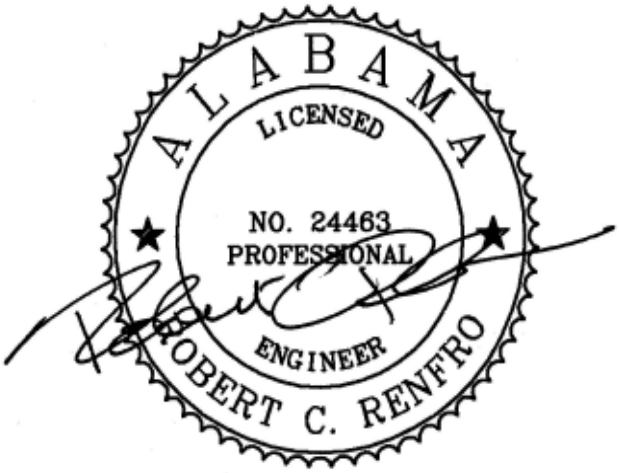
SECTION 26 00 00

COVER - RCR

DIVISION 26/27/28

ELECTRICAL SPECIFICATIONS

PREPARED BY



4/27/2026

SECTION 26 05 00

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 DESCRIPTION

A. General Conditions:
1. The accompanying General Conditions (front-end specifications) shall apply to and form a part of this section.

B. General Requirements:
1. Carefully examine General Conditions, other specification sections, and other drawings (in addition to Electrical) in order to be fully acquainted with their effect on electrical work.
2. Do all work in compliance with all applicable codes, laws, and ordinances, the National Electrical Safety Code, the National Electrical Code (hereinafter referred to as "Code"), applicable energy codes, and the regulations of the local utility companies. Obtain and pay for any and all required permits, inspections, certificates of inspections and approval, and the like.
3. Cooperate with other trades and contractors at job. Perform work in such manner and at such times as not to delay work of other trades. Complete all work as soon as the structure and installations of equipment will permit. Patch, in a satisfactory manner and by the proper craft, any work damaged by electrical workmen.
4. Electrical contracting firm shall be licensed as an electrical contractor in the state where work will be performed

1.2 GENERAL SCOPE OF ELECTRICAL WORK (REFER TO DRAWINGS FOR OTHER SPECIFIC SCOPE ITEMS)

A. Furnish all labor and materials to complete electrical work as shown on drawings and/or herein specified.

B. Remove all existing electrical equipment and wiring made obsolete by this project and remove or relocate all electrical services located on or crossing through the project property, either above or below grade, which would obstruct the construction of the project or conflict in any manner with the completed project or any code pertaining thereto. Dispose of salvageable materials as directed by the Architect. Contractor shall schedule meeting to review scope of electrical demolition and to confirm scope and phasing of proposed demolition with the owner in the presence of the prime consultant prior to start of any electrical demolition.

C. Furnish and install complete power, telephone and other electrical services as shown on drawings and/or specified herein.

D. Pay all electrical utility company service charges (if any) in connection therewith, including permanent meter deposit. Meter deposits will be refunded to Contractor at time of Owner's acceptance.

E. Furnish and install complete power distribution system as shown on drawings and/or specified herein.

F. Furnish and install disconnect switches for motors as shown on drawings and/or specified herein.

G. Furnish and install complete electrical grounding systems as shown on drawings and/or specified herein.

H. Install and connect electrical equipment mentioned in Division 26/27/28 Specifications or noted in drawings, whether furnished by electrical contractor or by others.
1. Where shown or specified, equipment furnished by others shall be installed and connected under this Contract.
2. Where shown or specified, Contractor shall receive, unpack, check and assume custody of equipment furnished by Others. Contractor shall assume responsibility for care and safekeeping of this equipment, when delivered into his custody. He shall protect it from moisture, dust and damage during construction and until Owner acceptance of project.

I. Furnish and install complete electrical lighting systems as shown on drawings and/or specified herein.

J. Furnish and install all electrical items shown on drawings and/or herein specified, unless shown or specified otherwise.

K. Furnish and install complete controls & auxiliary systems as shown on drawings and/or specified herein.

L. Furnish and install complete telephone/data raceway (including all outlet boxes, face plates, conduit raceways, telephone backboards, terminal cabinets, etc.), wiring and devices system as shown on drawings and/or specified herein.

M. Furnish and install a complete Fire Alarm System as shown on drawings and/or specified herein.

N. Furnish and install a complete Surge Protection System as shown on drawings and/or specified herein.

O. Furnish and install a complete Building Lightning Protection System as shown on drawings and/or specified herein.

P. Procure and pay for permits and certificates as required by local and state ordinances and fire underwriter's certificate of inspection.

Q. Balance loads as equally as practicable on services, distribution feeders, circuits and buses. Provide typewritten directory for each panel.

R. Unless specifically indicated or required otherwise, terminate all circuitry/cabling provided within this contract at associated equipment/devices/etc. in accordance with all applicable codes, standards and supplier requirements, whether associated equipment/device/etc. is furnished within this contract or by others.

S. Complete field testing, adjustment & startup of all systems listed above as shown on drawings and/or specified herein.

PART 2 - PRODUCTS

2.1 APPROVED MATERIALS AND DEVICES

A. Where not otherwise specified, provide only new, standard, first-grade materials/systems throughout, conforming to standards established by Underwriter's Laboratories, Inc., and so marked or labeled, together with manufacturer's brand or trademark. All equipment/systems subject to approval of Architect before installation. All like items and associated equipment/systems shall be of one manufacturer.

B. To ensure proper coordination, it is intended that all electrical equipment and materials specified in Division 26/27/28 of these specifications and shown on the electrical drawings be furnished and installed by the electrical sub-contractor. It will not be permissible for any of these items to be furnished directly by the general contractor without the electrical contractor's coordination.

C. To ensure commonality of spare parts, it is required that the electrical contractor provide the same brand for all circuit breakers, starters, power equipment, etc. provided under the following divisions of these specifications:
1. SECTION 26 24 16: POWER PANELBOARDS - CIRCUIT BREAKER TYPE
2. SECTION 26 24 17: LIGHTING PANELBOARDS
3. SECTION 26 28 16: SAFETY SWITCHES AND FUSES

2.2 SUBMITTALS

A. All submittals to the design team shall be accompanied by a letter summarizing all proposed deviations from specified products or pre-approved substitutions. The absence of such a letter shall be understood to indicate that the contractor intends to meet all contract requirements, regardless of cut-sheets/data-sheets provided within the submittal.

B. Submit to Architect ten (10) days prior to bid date three (3) copies of any items and/or manufacturers which are proposed as substitutes for those specified.

C. Submit to Architect promptly after award of Contract and prior to purchasing, the number of copies required by the contract. All drawings of a specific item or system shall be made in one submittal, and within thirty (30) days after award of Contract. Shop drawings of all power equipment shall contain exact details of device placement, phasing and numbering, in form of elevations, for each major piece of equipment. Shop drawings shall be submitted on the following:
1. SECTION 26 05 36: CABLE TRAYS
2. SECTION 26 09 43: LIGHTING CONTROL SYSTEM
3. SECTION 26 24 16: POWER PANELBOARDS - CIRCUIT BREAKER TYPE
4. SECTION 26 24 17: LIGHTING PANELBOARDS
5. SECTION 26 28 16: SAFETY SWITCHES AND FUSES
6. SECTION 26 41 00: LIGHTNING PROTECTION SYSTEM
7. SECTION 26 43 00: SURGE PROTECTIVE DEVICES
8. SECTION 26 50 00: LIGHTING MATERIALS AND METHODS
9. SECTION 27 10 00: STRUCTURED CABLING SYSTEM
10. SECTION 28 20 00: CCTV SURVEILLANCE SYSTEM - IP
11. SECTION 28 31 00: FIRE ALARM SYSTEM

12. SECTION 28 78 00: EMERGENCY RESPONDER RADIO COVERAGE SYSTEM
13. ALL POWER DISTRIBUTION EQUIPMENT (i.e. SWITCHBOARDS, PANELBOARDS, DRY TYPE TRANSFORMER, ETC.)
14. ALL ELECTRICAL AND TELECOMMUNICATION EQUIPMENT LAYOUTS - Submittals shall include ¼" = 1'-0" CAD drawings (hand drawn sketches will not be accepted) of each electrical room, IT room, electrical equipment stand, generator area, or any other similar area with electrical equipment. Drawings shall indicate all panelboards, transformers, switchboards, generators, equipment racks, control panels, HVAC equipment, etc. that are located in each electrical/IT area. Layouts shall show that each piece of electrical equipment has the clearances, working space and dedicated equipment space required by applicable codes. No conduits to equipment within these areas shall be installed until submittals have been provided and returned without exception by the design team.

D. The contractor shall fully review, comment upon and correct all shop drawings as required to assure compliance with contract documents prior to submittal to Architect. The failure of the contractor to properly review and correct shop drawings prior to submittal will result in rejection of shop drawings by the engineer. Review by the Architect will be for general conformance with contract documents. The contractor shall be fully responsible for correctness of all submitted dimensions, details, quantities and locations.

E. None of the above items shall be installed until shop drawings or catalog data have been reviewed by Architect without rejection or required resubmittal. Any listed item not submitted, even if specified, shall be considered not acceptable and shall be removed if directed.

F. Any required resubmittal will be reviewed by the Architect for conformance with previously issued comments only. The contractor shall be responsible for verifying that all items not specifically requiring resubmittal have not been altered from the previously reviewed submittal.

G. Material proposed for substitution shall be of the same quality, perform the same functions, conform to such physical dimensions and appearance as are required by the Architect. All material proposed for substitution is subject to the approval of the Architect and his authority for approval is final. No material proposed for substitution will be considered unless all submittal data complies with the drawings and specifications of Section 16 as to time of submission, number of copies of submittal, and detail requirements.

H. Samples of material shall be furnished where required by drawings or Division 26/27/28 Specification, or as requested by the Architect on items proposed as substitutes.

I. Submit to Architect a certificate of final inspection from local inspection department.

PART 3 - EXECUTION

3.1 SITE VISIT

A. The Contractor shall visit the site to determine existing dimensions and conditions affecting electrical work. Failure to do so in no way relieves Contractor of his responsibility under Contract.

3.2 CLEARANCE WITH UTILITIES

A. It shall be the responsibility of this Contractor, prior to bid, to reaffirm with the utility companies involved, that the locations, arrangement (and with power company voltage, phase, and metering required) and connections to utility service are in accordance with their regulations and requirements. If their requirements are at variance with these drawings and specifications, the Contract price shall include any additional cost necessary to meet those requirements without extra cost to Owner after a contract is entered into.

B. On many projects the utility company may levy charges due to locations, size or type service involved. The Contractor shall be responsible for these charges (including permanent meter deposit), unless such charges are not available prior to bid and Contractor so documents as described below. The meter deposit will be refunded to the contractor at time of Owner's acceptance.

C. Should above cost not be available, prior to bid, Contractor must submit a letter signed by a responsible utility company person so stating with his bid and in turn must be submitted by Prime Contractor with his bid to Owner. The cost will then be deleted from the Contract and become responsibility of the Owner.

D. Arrange with utility companies for such services as shown or herein specified and installation of meter where shown. Furnish with shop drawings a signed document from utility companies describing the location and type of services to be furnished and any requirements they may have. This document shall be signed for each utility company by a person responsible for granting such service.

3.3 WORKMANSHIP

A. All work shall be in accordance with the latest editions of NFPA 70 (National Electrical Code), NFPA 101 (Life Safety Code), National Electric Safety Code, International Building Code, applicable NECA standards and the rules and regulations of State and Local Authorities Having Jurisdiction.

B. All work shall be executed in a workmanlike manner and shall present a neat and mechanical appearance upon completion.

C. All equipment, devices, etc. shall be installed in accordance with manufacturer's recommendations.

D. All items shall be installed straight and plumb in a workmanlike manner and care shall be exercised so that like items are mounted the same position, heights and general location.

E. Keep site clean of accumulation of cartons, trash and debris.

3.4 SAFETY

A. The contractor is solely responsible for all job safety. Architect assumes no responsibility for job safety. Maximum consideration shall be given to job safety and only such methods as will reasonably insure the safety of all persons shall be employed. The codes and regulations of OSHA shall be given strict compliance as well as such other codes, laws, and regulations as may be applicable.

3.5 CONTRACT DOCUMENTS

A. Contract documents indicate diagrammatically, extent, general character and approximate location of work. Where work is indicated but minor details omitted, furnish and install it complete so as to perform its intended functions. For details and mechanical equipment, follow drawings provided by other disciplines (Architectural, Mechanical, Structural, Civil, etc.) and fit electrical work thereto.

B. Contract documents consist only of the hardcopy documents issued by the Prime Architect. Electronic documents issued directly by the electrical engineer to the contractor and/or its sub-contractors/vendors are issued for convenience only (electronic documents are not formal contract documents).

C. If the contractor and/or one of its suppliers require a one-time transfer of electronic files of the current electrical construction documents to prepare shop drawings (or for another similar purpose), it shall:
1. Sign a waiver prepared by the electrical engineer prior to the transmittal of these files.
2. Agree to pay the electrical engineer a fee of $50.00 per drawing, up to a maximum of $400 per transfer, payable upon receipt of the files.
3. To the fullest extent permitted by law, indemnify, hold harmless, and defend JRA from all claims, damages, losses and expenses, including attorneys' fees arising out of or resulting from the use of the CAD files.

D. Take finish dimensions at job in preference to scaled dimensions.

E. Except as above noted, make no changes in or deviations from work as shown or specified except on written order of Architect.

3.6 UNDERGROUND UTILITY/EQUIPMENT COORDINATION

A. Prior to commencement of work, verify exact locations of all existing or proposed underground utilities and/or underground equipment and verify that proposed electrical installation does not conflict with these items. Notify Architect immediately if any conflict is found.

3.7 EQUIPMENT STORAGE

A. Store all electrical equipment in dry, covered locations as directed by equipment manufacturers. Contractor shall be responsible for replacing or repairing improperly-stored equipment as directed by Architect.

3.8 EXCAVATION, CUTTING AND PATCHING

A. Perform all cutting and excavating as necessary for installation of electrical systems, unless specifically covered under another section. After Architect's observation, complete all excavation, filling and backfilling as directed under specifications for preparation of site and earthwork. Foundations for equipment shall be as specified under concrete section. Concrete pads shall be minimum of 6" thick; unless greater thickness required by equipment manufacturer. Obtain specific approval of Architect before cutting into any structural members.

B. For all such work employ competent workmen, and finish up in neat and workmanlike manner, equal to quality and appearance to adjacent work.

3.9 PENETRATIONS

A. All penetrations in water tight barriers shall be made so that barrier rating is not compromised. Furnish roof flashing for all equipment installed under Division 26/27/28 that penetrates through the roof. Appropriate flashing is specified under roofing and sheet metal section. Supply these flashings for installation under roofing and sheet metal section.

B. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly to maintain the fire/smoke rating of the associated membrane.

C. Where penetrations are required through structural elements, verify penetration locations and sizes with structural engineer. In no case shall the structural integrity be compromised without written approval from structural engineer.

3.10 INSTALLATION OF EQUIPMENT - GENERAL

A. Care shall be exercised in exact routing and location of all items so as not to obstruct access to equipment, personnel walkways, or expose it to potential mechanical damage.

B. Items shall be securely anchored and/or fastened. Provide proper support for all equipment, devices, conduits, boxes, panels, etc. as required by code and for a workmanlike installation. Provide guy wiring for wood poles where required to prevent leaning. All construction shall meet the seismic design requirements of the building code. Items (especially transformers, light fixtures, equipment racks, freestanding gear, etc.) installed in seismic zones C, D, E or F shall be supported and braced per applicable codes and standards.

C. All wall, pole or frame-mounted electrical equipment shall be mounted to metal unistrut (or similar) frames of same material as electrical equipment. For example, pole-mounted painted or galvanized steel disconnect switches shall be mounted to galvanized steel unistrut frames.

D. All electrical equipment, furnished by Contractor or by others shall be covered and protected during construction.

E. All control cabinets, panels, motor control centers and other electrical cabinets and enclosures shall have all trash removed and be vacuumed clean. All foreign paint, etc., shall be removed from exterior and all scratches in finish touched up with same color and material as original. Any rusted areas shall be sanded, primed and repainted.

F. All relays, starters, push-button and other control devices shall be cleaned and if necessary, lubricated with CRC 2-26 to assure free operation.

3.11 MOTORS, STARTERS AND CONTROLS

A. Unless otherwise specified or shown, all motors will be furnished and installed under other sections of this specification.

B. Electrical Contractor shall install all starters and all electrical power wiring and connections to motors and starters.

C. Unless otherwise specified or shown, all control items for motors shall be furnished, installed and wired in conduit under other divisions of this specification.

3.12 CIRCUITS AND BRANCH CIRCUITS

A. Outlets shall be connected to branch circuits as indicated on drawings by circuit numbers. No more outlets than are indicated shall be connected to a circuit.

B. Branch circuit homeruns shall be installed as shown on drawings. Multiple homerun conduits shall not be combined by contractor into larger, single homerun conduits unless specific permission is granted by the Engineer.

3.13 LUG/TERMINAL RATINGS

A. All lug/terminal ratings, sizes, locations, types, etc. shall be coordinated with the associated conductor sizes, types, routings, etc. by the contractor.

B. All lugs/terminals/etc. shall be rated for 75 degree C terminations (minimum, unless specified otherwise).

3.14 EQUIPMENT FAULT CURRENT RATINGS

A. All equipment and breakers shall meet the minimum RMS symmetrical interrupting capacity ratings shown on plans for the associated distribution equipment. All interrupting ratings shall be full ratings. Where new devices or breakers are added to existing distribution equipment, the new devices/breakers shall have interrupting ratings matching or exceeding that of the existing distribution equipment.

3.15 OUTLET LOCATION

A. Symbols shown on drawings and mounting heights indicated on drawings and in specifications are approximate only. The exact locations and mounting height must be determined on the job and it shall be the Contractor's responsibility to coordinate with other trades to insure correct installation.

3.16 IDENTIFICATION

A. Each panel shall have each circuit identified. Panels without branch circuit nameplates shall have typewritten directories.

B. Each individually mounted switch, circuit breaker, starter and/or any other control or protective device shall identify equipment fed and fuse size, if any, by engraved plastic nameplate, white with black letters, screw attached.

C. See Specification Section 26 05 53 for additional requirements.

3.17 GROUNDING

A. All equipment shall be grounded and bonded in accordance with all state/local regulations, The National Electrical Code and as specified herein.

3.18 TELEPHONE WORK

A. Provide telephone raceways, outlets and backboards, as shown. Provide additional work as described in Specification Section 27 10 00 and/or shown on drawings. Bond all raceways together at backboards and provide No. 6 ground wire extending from raceway bonds to cold water pipe, in 1/2 inch raceway. Carefully ream ends of all raceways.

3.19 PAINTING

A. Refer to Painting/Finishing specifications for requirements regarding field painting of exposed conduit. Any scratches, dents or rust spots in conduit electrical enclosures, panels, motor control or any other electrical items shall have the dents removed, and they, along with any rust spots or scratches, sanded and touched up with the same exact color paint as original finish.

3.20 ACCEPTANCE TESTING

A. Upon completion of work, the entire electrical system installed within this project shall be tested and shall be shown to be in perfect working condition, in accordance with the intent of the specifications and drawings. It shall be the responsibility of the Electrical Contractor to have all systems ready for operation and to have an electrician available to operate same in accordance with and under the supervision of the observation representative(s) of the Architect. The Electrician shall be available to assist in removal of panel fronts, etc., to permit inspection as required.

B. The electrical sub-contractor shall include in bid price start-up assistance and training from a certified representative of the manufacturer for the following systems:
1. SECTION 26 09 43: LIGHTING CONTROL SYSTEM
2. SECTION 27 10 00: STRUCTURED CABLING SYSTEM
3. SECTION 28 20 00: CCTV SURVEILLANCE SYSTEM - IP
4. SECTION 28 31 00: FIRE ALARM SYSTEM
5. SECTION 28 78 00: EMERGENCY RESPONDER RADIO COVERAGE SYSTEM

3.21 OPERATION AND MAINTENANCE DATA

A. One set of marked “AS BUILT” drawings, three (3) sets of all equipment catalog and maintenance data and three (3) sets of all final shop drawings, on all equipment requiring same shall be turned over to owner. These items shall be bound in hard back book. Contractor shall explain and demonstrate all systems to Owner’s representative.

3.22 GUARANTY-WARRANTY

A. Furnish a written Guarantee-Warranty, countersigned and guaranteed by General Contractor, stating:
1. That all work executed under this section will be free from defects of workmanship and materials for a period of one (1) year from date of final acceptance of this work.
2. Above parties further agree that they will, at their own expense, repair and replace all such defective work, and all other work damaged thereby, which becomes defective during the term of the Guaranty-Warranty.

END OF SECTION 26 05 00

SECTION 26 05 19

POWER CONDUCTORS AND CABLES 51V-600V

PART 1 - GENERAL

1.1 DESCRIPTION

A. Power Wires and Cables

B. Low Voltage Wires and Cables

PART 2 - PRODUCTS

2.1 POWER WIRES AND CABLES - 600 VOLT

A. General: Conductors shall have current carrying capacities as per N.E.C. and with 600 volt insulation, #12 minimum except for controls and fixture wire. Conductors shall be copper.

B. General Application (see below for exceptions):
1. At or Below Grade (including within slab-on-grade):
   a. #8 or larger conductors:
      1) XHHW or RHH/RHW/USE stranded (in conduit).
   b. #10 or smaller conductors for circuits terminating at motors:
      1) THHN/THWN or XHHW stranded (in conduit).
   c. #10 or smaller conductors (excluding circuits terminating at motors):
      1) THHN/THWN or XHHW solid (in conduit).
2. Above Grade:
   a. #8 or larger conductors:
      1) THHN/THWN, XHHW or RHH/RHW/USE stranded (in conduit).
   b. #10 or smaller conductors for circuits terminating at motors:
      1) Where Exposed within Electrical Rooms OR Concealed in Wall/Ceiling Cavities (not concrete encased, etc.):
         a) THHN/THWN, XHHW or RHH/RHW/USE stranded (in conduit) or
         b) Metal-Clad (MC) cabling with THHN/THWN stranded conductors (conduit not required).
      2) Other Locations (where exposed outside electrical rooms or concrete encased): THHN/THWN, XHHW or RHH/RHW/USE stranded (in conduit).
   c. #10 or smaller conductors (excluding circuits terminating at motors):
      1) Where Exposed within Electrical Rooms OR Concealed in Wall/Ceiling Cavities (not concrete encased, etc.):
         a) THHN/THWN, XHHW or RHH/RHW/USE solid (in conduit) or
         b) Metal-Clad (MC) cabling with THHN/THWN solid conductors (conduit not required).
      2) Other Locations (where exposed outside electrical rooms or concrete encased): THHN/THWN, XHHW or RHH/RHW/USE solid (in conduit).
3. Metal-Clad (MC) cabling shall be rated for redundant grounding where installed in patient care areas per N.E.C. Article 517.
4. Power Wire and cable shall be as manufactured by Southwire, Rome, Encore Wire, American Insulated Wire, Okonite, Phelps-Dodge, Amercable, Aetna or approved equal.

C. Emergency Feeder Wiring
1. Where specifically required by NEC articles 700, 701, or other similar sections, feeder-circuit wiring for emergency systems and legally-required standby systems shall be a listed electrical circuit protective system consisting of 2-hour fire-rated, mineral insulated, copper-sheathed wiring cable (Pyrotenax System 1850 or equal).

D. Class 1 Control Cabling (120VAC Control Circuits, Etc.)
1. Unless specified otherwise, Class 1 control cabling shall:
   a. Be rated for exposed cable tray installation.
   b. Be plenum rated.
   c. Be UL-rated for the proposed application.
   d. Be multi-conductor with overall outer sheath as required by the application. The insulation of each conductor within the overall multi-conductor cable shall be uniquely color-coded. Ground conductors (when provided) within the multi-conductor cable shall have green insulation. Conductors with green insulation shall not be used for conductors other than ground.
   e. Utilize copper conductors.
   f. Have wire gauge as required to limit voltage drop to acceptable limits determined by the system supplier and to meet all applicable code requirements.
   g. Where installed underground, within slab-on-grade or in exterior locations, be rated for wet locations.
   h. Where required for specific systems, meet the specific requirements (conductor quantity, wire gauge, insulation type, shielding, etc.) of the system supplier.
   i. Be rated for 600V.
   j. Be industrial grade.
   k. Have stranded conductors.
   l. Have sunlight/oil-resistant PVC/Nylon insulation and jacket with ripcord.
2. Control cabling shall be as manufactured by Belden, AlphaWire or General Cable.

E. Fixture Wiring
1. Conductor Types:
   a. Type TFFN or XFF.
2. Minimum Sizes:
   a. For fixtures up to 300 watts: #16.
   b. For fixtures over 300 watts up to 1500 watts: #14.
   c. For fixtures over 1500 watts: as required.
   d. Conductors to concrete pour fixtures: #12.
3. Fixture wire shall extend only from fixture to first junction, and not over 6 feet, except for concrete pour units.

2.2 WIRE CONNECTIONS:

A. All connector types:
1. Shall be properly rated for the proposed application by UL and per the manufacturer.

B. At Motor Connections (within motor terminal boxes):
1. On Unshielded Wire:
   a. Single conductor per phase: shall be made with insulated set screw connectors or 3M 5300 Series 1kV Motor Lead Connections kits with mechanical lugs as required.

b. Multiple conductors per phase: shall be made with insulated mechanical lugs, rated for the associated motor cable types, by Polaris or Ilsco.

2. On Shielded Power Wire:
   a. The braided shields and internal grounding conductors of shielded power (not instrumentation) cables shall be grounded at BOTH ends (at VFD/starter and at motor) with a termination kit provided by the cable supplier. This termination kit shall include a connection ring that makes contact around the full circumference of the braided shield, and connects all internal grounds to a common external ground point.

C. Other Dry locations:
1. On Wire larger than #10: shall be made with solderless, non-insulated compression-type connectors meeting requirements of Federal Specification WS-610e for Type II, Class 2 and shall be covered with Scotch #33 electrical tape so that insulation is equal to 150% of conductor insulation.
2. On Wire #10 and smaller: shall be made with one of the following:
   a. Ideal Wing Nuts or equal by 3M .
   b. Ideal Push-In Wire Connectors (for #12 and smaller only).

D. Other Wet/Damp locations:
1. On Wire larger than #10: shall be made with underground/direct-burial, waterproof rated EPDM or TPE-insulated connectors by Ilsco, Burndy or T&B.
2. On Wire #10 and smaller: shall be made with one of the following:
   a. Ideal Weatherproof or Underground Wire Connectors pre-filled with 100% silicone sealant as required by the application.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. All wires and cables shall be installed in conduit unless specifically noted otherwise.

B. Metal-clad (MC) cabling (not required to be installed within conduit) may be used for above-grade, concealed branch circuits where allowed by code. MC cable installation shall:
1. NOT be installed exposed except in electrical rooms.
2. be provided with dedicated neutrals for all multi-wire circuits. Conductors shall be color coded as described below.
3. be run orthogonal with the building structure.
4. be supported per N.E.C. requirements. At a minimum MC cabling shall be supported on six foot intervals and within 12” of all outlet/junction boxes.
5. be supported independently from the building structure and shall not come into contact with other building systems (ductwork, piping, conduits, etc.).
6. be rated for redundant grounding where installed in patient care areas per N.E.C. Article 517.

C. All joints and splices on wire shall be made with solderless connectors, and covered so that insulation is equal to conductor insulation.

D. No splices shall be pulled into conduit.

E. No conductor shall be pulled until conduit is cleaned of all foreign matter.

F. Wire and cable shall be neatly formed, bundled and tied in all panelboards, wireways, disconnect switches, pullboxes, junction boxes, cabinets and other similar electrical enclosures.

G. All wires and cables installed in underground or other wet locations shall be rated by the manufacturer for wet locations.

H. Network cabling shall be continuous from endpoint to endpoint and shall not be spliced unless specifically noted otherwise.

I. All conductors/cabling (including spare conductors) shall be properly terminated unless specifically directed otherwise. See above for general termination hardware requirements.

3.2 POWER WIRE AND CABLE INSTALLATION:

A. No power conductor shall be smaller than #12 except where so designated on the drawings or hereinafter specified.

B. Multi-wire lighting branches shall be used as indicated.

C. Where more than three current-carrying conductors are installed in a single raceway or cable, conductors shall be derated as indicated in NEC Table 310.15(B)(3)(a).

D. Raceways/cables shall generally not be installed exposed to sunlight on roofs unless specifically required. Where raceways or cables are installed exposed to sunlight on roofs, conductors shall be derated with ampacities adjusted per NEC Table 310.15(B)(3)(c).

E. In installing parallel power conductors, it is mandatory that all conductors making up the feeder be exactly the same length, the same size, the same type of conductor with the same insulation. Each group of conductors making up a phase or neutral must be bonded at both ends in an approved manner.

F. In installing overhead main power services, a minimum of 5’-0” of cable per run shall be extended beyond the weatherhead(s) for connection to service drop. Confirm exact requirements with local utility company.

3.3 WIRE CONNECTIONS

A. See Part 2 above for material types.

B. Aluminum Wire Connections:
1. Where aluminum wiring is allowed, connections shall utilize compression fittings, no exceptions (Anderson Versa Crimp or equal).

C. Any stranded wire connection to wiring devices shall be made with crimp type terminals.

D. All electrical connections and terminals shall be tightened according to manufacturer’s published torque-tightening values with calibrated torque wrenches as required to clearly indicate final torque value to the contractor. Where manufacturer’s torque values are not provided, those specified in UL 486A & 486B shall be used.

E. All connections and connector types shall be installed in strict compliance with all requirements

of the connector manufacturer.

F. Under no condition shall the specified conductors be connected to terminals rated less than 75°C. Where conductors sized #1 or smaller are shown to be terminated at equipment and the terminals of that equipment are rated for less than 75°C, contractor shall install junction box near equipment to capture the specified conductors, splice with compression connections (rated for a least 75°C) and extend conductors with ampacity rating as required by NEC (based on terminal temperature rating) to equipment terminals. The length of the conductors to be terminated shall be as directed by the AHJ but not less than 48 inches.

3.4 LOW VOLTAGE (LESS THAN 50V) CONTROL AND NETWORK CABLE INSTALLATION:

A. All wires and cables shall be installed in conduit unless specifically noted otherwise. Low voltage control and/or network cabling located within concealed, accessible ceiling spaces (such as above lay-in ceilings) may be run without conduit if the following requirements are met:
1. Cabling shall be plenum-rated, multi-conductor.
2. Cabling shall be supported by cable tray or with J-hook supports on intervals not to exceed 5'-0" on center. Cabling shall be supported solely from the cable tray or j-hooks supported from the building structure, without using piping, ductwork, conduit or other items as supports.
3. Cabling shall be properly bundled with plenum-rated Velcro straps on intervals not to exceed 30" on center.
4. Properly-sized conduit(s) shall be provided wherever cabling enters an inaccessible or exposed area (such as above gyp board ceilings or through walls). End bushings shall be provided on both ends of all raceway terminations. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly.

3.5 CIRCUITS AND BRANCH CIRCUITS

A. Outlets shall be connected to branch circuits as indicated on drawings by circuit number adjacent to outlet symbols, and no more outlets than are indicated shall be connected to a circuit.

3.6 LABELING AND COLOR CODING OF WIRE AND CABLE

A. Refer to Specification Section 26 05 53 for all labeling requirements.

B. A color coding system as listed below shall be followed throughout the network of branch power circuits as follows:

PHASE	120/208/240/ COLOR	120/240 HIGH LEG DELTA COLOR	277/480 VOLT COLOR
A	BLACK	BLACK	BROWN
B	RED	ORANGE (FOR HI-LEG)	ORANGE
C	BLUE	BLUE	YELLOW
NEUTRAL	WHITE	WHITE	GRAY
GROUND	GREEN	GREEN	GREEN

C. Where dedicated neutrals are installed for multi-wire branch circuits, the neutral conductors shall be color coded as follows:

PHASE	120/208/240/ COLOR	120/240 HIGH LEG DELTA COLOR	277/480 VOLT COLOR
NEUTRAL A	WHITE W/ BLACK TRACER	WHITE W/ BLACK TRACER	GRAY W/ BROWN TRACER
NEUTRAL B	WHITE W/ RED TRACER	WHITE W/ ORANGE TRACER (FOR HI-LEG NEUTRAL)	GRAY W/ ORANGE TRACER
NEUTRAL C	WHITE W/ BLUE TRACER	WHITE W/ BLUE TRACER	GRAY W/ YELLOW TRACER

D. Control Conductors: Shall be color coded by use of colored "tracers". No control circuit shall contain two identical conductors. For example, a set of five (5) control conductors for a pushbutton station represents one (1) control circuit which would require five (5) uniquely-colored control conductors.

3.7 TESTING

A. The insulation resistance of all feeder conductors (feeding electrical distribution equipment such as switchboards, panelboards, transfer switches, transformers, etc.) shall be tested at the load side of the feeder breaker with a 1000-volt DC Megger Tester prior to energization or final termination. Any feeder conductor with an insulation resistance less than the recommended minimums in the latest version of NETA Acceptance Testing Specification ("ATS") standard shall be replaced by the contractor at the contractor's expense. All final test results shall be clearly documented (with date, time, feeder, results, test equipment, etc.), and the final test results shall be submitted to the design team for review.

END OF SECTION 26 05 19

SECTION 26 05 26

GROUNDING

PART 1 - GENERAL

1.1 GENERAL

A. THE WORK UNDER THIS SECTION INCLUDES BUT IS NOT LIMITED TO GROUNDING OF THE FOLLOWING:
1. Service Equipment.
2. Transformers.
3. Non-current carrying conductive surfaces of equipment.
4. Metal Buildings.
5. Structures.
6. Other Equipment.

1.2 GENERAL REQUIREMENTS

A. All equipment, building steel, and main service shall be effectively and permanently grounded with a conductor cross section as required by the National Electrical Code and of capacity sufficient to insure continued effectiveness of the ground connections for fault current. Ground conductors shall be as short and straight as possible, protected from mechanical injury and, if practicable, without splice or joint.

B. All grounding connections shall be installed in accordance with the National Electrical Code and all local codes and requirements. Such codes shall be considered minimum requirements and the installation of the grounding system shall insure freedom from dangerous shock voltage exposure and provide a low impedance ground fault path to permit proper operation of overcurrent and ground fault protective devices.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. All grounding conductors shall be insulated with green colored, 600 volt insulation unless noted otherwise.

B. Motors having power supplied by single conductor wire in conduit shall be grounded through the conduit system. Flexible conduit shall be “jumpered” by an appropriate bonding conductor.

2.2 GROUNDING ELECTRODES

A. Grounding electrodes shall be copper-clad steel rods 3/4 inch in diameter and ten feet long. Where longer electrodes are necessary to reduce the ground resistance, Contractor shall provide sectional rods, connectors, drive heads, etc.

2.3 CONNECTIONS

A. All conductor-to-conductor, conductor-to-ground rod, conductor-to-structure, conductor-to-fence connections of #6 and larger sized conductors and underground ground connections shall

be permanent exothermic welded connections (Cadweld or equal) unless otherwise noted on applicable drawings.

B. Connections to equipment shall be by bolted compression type lugs (except for motors). When the conductor is #6 and larger, the lug shall be joined to the conductor by an exothermic weld (Cadweld or equal).

C. Motors to be grounded by the grounding conductors run with the power conductors shall have a split-post grounding stud installed in the connection box.

D. Each cast pull box or junction box shall have a ground lug, connected to largest ground conductor to enter box.

E. Ground connections at conduit terminations shall be made by approved grounding bushings (see Raceways Specification Section for additional requirements).

2.4 MANUFACTURERS

A. Conduit clamps and connectors shall be manufactured by Raco, OZ., or Ercon.

B. Lugs shall be as manufactured by Square “D”, Burndy, or T and B.

C. Exothermic weld connections shall be as manufactured by Cadweld, or approved equal.

D. Ground rods shall be as manufactured by Joslyn or McGraw Edison.

E. Split post grounding shall be as manufactured by Burndy or T and B.

PART 3 - EXECUTION

3.1 MAIN SERVICE GROUND

A. The main service grounding electrode system shall consist of the following items bonded together by the grounding electrode conductor:
1. The main underground cold water pipe (metal).
2. The metal frame of the building.
3. Driven ground rods. Ground rods shall be embedded at the lowest point in the building and below the permanent moisture level. Ground rods shall be spaced a minimum of ten (10) feet apart and connected in parallel until resistance to ground does not exceed five (5) ohms.

B. The grounding electrode system shall be connected to the grounded conductor (neutral) on the supply side of the service disconnecting means by a grounding electrode conductor not smaller than that shown in Table 250.66 of the N.E.C. The main service equipment grounding conductor shall be connected to the grounding conductor on the supply side of the service disconnecting means in accordance with Table 250.122 of the N.E.C. for the ampere rating of the service entrance equipment. Where in a service entrance switchboard, the equipment grounding conductor shall not be less than 25% of the main bus rating. These connections shall be made inside the service entrance equipment enclosure.

3.2 TRANSFORMER GROUNDS

A. Dry type insulation transformers with a grounded conductor in the secondary shall be grounded in accordance with N.E.C. Section 250-30.

3.3 EXPOSED NON-CURRENT-CARRYING METAL PARTS

A. General: Ground connections to equipment or devices shall be made as close to the current carrying parts as possible, that is, to the main frame rather than supporting structures, bases or shields. Grounding connections shall be made only to dry surfaces that are clean and dry. Steel surfaces shall be ground or filed to remove all scales, rust, grease, and dirt. Copper and galvanized steel shall be cleaned to remove oxide before making welds or connections. Code size ground conductors shall be run in all power conduits and properly terminated at each end.

B. Ground conductors shall be routed as straight as possible. Where possible, ground conductors shall be routed such as to avoid bends exceeding 90 degrees or with a radius of less than 8".

C. Motors: Exposed non-current-carrying metal parts, shall be grounded by a grounding conductor either run with power conductors, and/or separate grounding conductors. Drawings will show method(s) to be used. The ground conductors with all motor conductors shall be connected to the ground buss in the motor connection box. Jumper connections shall be installed between frames and rigid conduit for equipment having flexible conduit connections (sealtight). All AC motor grounds shall provide a low impedance path to ground.

D. Raceways & boxes: All raceways, conduits, armored or shielded cable and all exposed non-current carrying metal parts shall be grounded. Such items shall be bonded together and permanently grounded to the equipment ground buss. Metallic conduits shall be connected by grounding or clamps to ground buss. Flexible "jumpers" shall be provided around all raceway expansion joints. Bonding straps for steel conduit shall be copper. Jumper connections shall be provided to effectively ground all sections or rigid conduit connected into plastic pipe. No metallic conduit shall be left ungrounded. In conduit systems interrupted by junction or switch boxes where locknuts and bushings are used to secure the conduit in the box, the sections of conduit and box must be bonded together. If conduit, couplings or fittings have a protective coating or non-conductive material, such as enamel, such coating must be thoroughly removed from threads of both couplings and conduit and the surface of conduit or fitting where the ground clamp is secured.

E. Enclosures: Metal conduits entering free standing motor control centers, switchboards or other free standing equipment shall be grounded by bare conductors and approved clamp. Any conduits entering low voltage (480 volts or below) equipment through sheet metal enclosure and effectively grounded to enclosure by double locknut or hub need not be otherwise bonded.

F. Equipment: In addition to equipment grounding provisions mandated by code requirements, additional equipment grounding provisions (including local ground rods, connections, etc.) shall be provided by the contractor as directed by equipment suppliers.

G. Both ends of ground busses in motor control centers, switchboards, etc., shall be separately connected to the main ground buss to form two separate paths to ground.

H. Fences and Grills: Fences and metal grills around equipment carrying voltage above 500 volts between phases shall be bonded together and to ground. Fences and grill work shall be grounded at every post, column, or support, and on each side of every gate.

3.4 ACCEPTANCE DOCUMENTATION AND TESTING

A. Contractor shall take and store photographs of all underground grounding system connections prior to burial of connections, for review by Engineer.

B. Upon completion of work, the entire ground system shall be shown to be in perfect working condition, in accordance with the intent of the Specifications.

C. Contractor shall measure the resistance between the main ground bonding jumper to true earth ground using the Fall of Potential method as described by ANSI/IEEE Standard 81 ("Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of an Earth System"). If the measured value is greater than five ohms, additional grounding electrodes shall be installed as described in Part 3.1 above. The final ground resistance value shall be submitted in writing, and documented via picture of the meter reading from the Fall of Potential test, to the Architect prior to the final observation, and shall be included in final O&M documentation.

END OF SECTION 26 05 26

SECTION 26 05 33

RACEWAYS

PART 1 - GENERAL

1.1 DESCRIPTION

A. THE WORK UNDER THIS SECTION INCLUDES BUT IS NOT LIMITED TO THE FOLLOWING:
1. Conduits
2. Conduit Fittings
3. Couplings & Connectors
4. Bushings
5. Raceway Hardware, Conduit Clamps & Supports
6. Watertight Entrance Seal Devices

PART 2 - PRODUCTS

2.1 CONDUITS

A. Rigid Galvanized Steel and I.M.C.:
1. Shall be galvanized outside and inside by hot dipping.
2. Shall be as manufactured by Republic, Wheatland, Triangle, Pittsburg Standard, Youngstown, Allied or equal.

B. E.M.T.:
1. Shall be Electro-Galvanized.
2. Shall be as manufactured by Republic, Wheatland, Triangle, Pittsburg Standard, Youngstown, Allied or equal.

C. Rigid Aluminum:
1. Shall be manufactured of 6063 Alloy, T-1 temper.
2. Shall be as manufactured by Republic, Wheatland, Triangle, Pittsburg Standard, Youngstown, Allied or equal.

D. Schedule 40 and 80 PVC:
1. Shall be composed of polyvinyl chloride and shall be U.L. rated type 40 or 80 for use with 90 degree rated conductors. Conduit shall conform to NEMA Standards and applicable sections of N.E.C.
2. The conduit manufacturer shall have had a minimum of 5 years experience in the manufacture of the products. Non-metallic raceways shall be as manufactured by Carlon, Triangle, Can-Tex, Allied or equal.

E. HDPE Innerduct
1. Shall be composed high density polyethylene and shall be orange in color, unless noted otherwise.
2. Shall be corrugated unless noted otherwise.
3. Shall be manufactured by Carlon, Ipex or equal.

F. Flexible Metallic Conduit:
1. Shall be continuous spiral wound and interlocked galvanized material, code approved for grounding.

G. Liquidtight Flexible Metallic Conduit:
1. Shall be galvanized steel-core sealtite, code approved for grounding.
2. Shall have an outer liquidtight, nonmetallic, sunlight-resistant jacket over an inner flexible metal core.
3. Shall be as manufactured by Electric-Flex, Anaconda or equal.

2.2 FITTINGS, COUPLINGS & CONNECTORS

A. Rigid Galvanized Steel and I.M.C. couplings and connectors shall be standard threaded type, galvanized outside and inside by hot dipping. Threadless and clamp type are not acceptable. Couplings/connectors shall be as manufactured by Raco, Efcor, or Appleton or equal.

B. All rain tight connectors shall be threaded Myers or approved equal, rated for outdoor application.

C. E.M.T. couplings and connectors shall be set screw, or steel compression type. All couplings and connectors shall be 720B, 730, 750B, or 760 series of Efcor or equal series of Raco. Pressure indented type connectors or cast metal will not be approved for any location. E.M.T. couplings and connectors shall be as manufactured by O-Z/Gedney, T&B, Efcor, Raco, Midwest or equal. E.M.T. fittings, couplings and connectors located within concrete (where allowed) shall be compression type and shall be adequately sealed with tape to ensure a concrete-tight seal.

D. Rigid Aluminum couplings and connectors shall be standard threaded type, of the same alloy as the associated conduit. Threadless and clamp type are not acceptable. Fittings shall be as manufactured by Thomas & Betts, Crouse-Hinds, Appleton, Pyle-National or equal.

E. All PVC couplings, adapters, end bells, reducers, etc., shall be of same material as conduit.

F. Liquidtight Flexible Metallic Conduit connectors shall be liquidtight with insulating throat or end bushing, designed for application with Liquidtight Flexible Metallic Conduit. Fittings shall be as manufactured by Efcor, Raco, Midwest or equal.

G. All LB unilets sizes 1 ¼” or larger shall have rollers.

H. Miscellaneous conduit fittings shall be as manufactured by Appleton, Crouse-Hinds, Pyle-National, Russell & Stoll or equal.

2.3 BUSHINGS

A. All non-grounding rigid bushings 1-1/4” and larger shall be the insulating type (O-Z/Gedney type “BB” or equal by T&B, Midwest Electric or Penn Union).

B. All non-grounding rigid bushings 1” and smaller shall be threaded malleable iron with integral noncombustible insulator rated for 150°C. Non-grounding rigid conduit bushings shall be O-Z/Gedney type “B” or equal by T&B, Midwest Electric or Penn Union.

C. All grounding rigid bushings shall be threaded malleable iron with integral noncombustible insulator rated for 150°C. All grounding rigid conduit bushings shall be O-Z/Gedney type "BLG" or equal by T&B, Midwest Electric or Penn Union.

2.4 HARDWARE, CONDUIT CLAMPS AND SUPPORTS

A. All hardware such as expansion shields, machine screws, toggle bolts, "U" or "J" bolts, machine bolts, conduit clamps and supports shall be of corrosion resistant materials (stainless steel, aluminum, galvanized or plated steel, or other approved materials).

B. Hardware in contact with aluminum handrails, plates or structural members and all hardware in exterior, wet or corrosive areas shall be type 316 stainless steel or aluminum (with bitumastic paint coating to isolate aluminum from contact with concrete where necessary) unless specifically noted otherwise.

C. Supports in exterior, wet or corrosive locations shall be type 316 stainless steel or aluminum (with bitumastic paint coating to isolate aluminum from contact with concrete where necessary) unless specifically noted otherwise.

D. Supports in extremely corrosive environments (such as chlorine or fluoride storage rooms) shall be PVC-Coated steel unless specifically noted otherwise.

E. Hardware and conduit clamps shall be as manufactured by Efcor, Steel City, G.A., Tinnerman or equal.

2.5 WATERTIGHT ENTRANCE SEAL DEVICES

A. For new construction, seal devices shall consist of oversized sleeve and malleable iron body with sealing rings, pressure rings, sealing grommets and pressure clamps as required (O-Z/Gedney type FSK/WSK or equal).

B. For cored-hole applications, seal devices shall consist of assembled dual pressure disks with neoprene sealing rings and membrane clamps as required (O-Z/Gedney type CSM or equal).

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Minimum Diameter: 1/2-inch.

B. Raceway Type: Raceway types shall be as specified below, unless indicated otherwise on drawings:
   1. Exterior, Exposed: Rigid Galvanized Steel or I.M.C. unless otherwise noted.
   2. Other Exterior (Concrete-Encased or Direct Earth Buried): Schedule 40 PVC. PVC conduit shall convert to metallic conduit prior to exiting concrete-encasement or direct earth burial. See "transition" items below for additional requirements. Conduits shall be left exposed until after Architect's observation.
   3. Interior, Exposed:
      a. Hazardous Locations: Rigid Galvanized Steel .
      b. Wet Locations (including, but not limited to, Pump Rooms, Wet Wells, Underground Vaults, and other similar locations): Rigid Galvanized Steel or I.M.C. .

c. Dry Locations Where Subject to Mechanical Damage (including, but not limited to, below 10'-0" A.F.F. in shop, storage, warehouse and other similar areas): Rigid Galvanized Steel or I.M.C..
d. Extremely Corrosive Locations (Chlorine Storage Rooms, Fluoride Storage Rooms and other similar areas): Schedule 80 PVC.
e. Other Dry Locations: E.M.T.

4. Interior, Concealed:
   a. Embedded inside Poured Concrete Walls, Ceilings or Floors, with a minimum of 2" of concrete between finished surface and outer wall of conduit on all sides, where no anchor bolts, screws or other similar items will be installed: Schedule 40 PVC. PVC conduit shall convert to metallic conduit (exact type as specified elsewhere within this section) prior to exiting poured concrete-encasement of wall, ceiling, floor or ductbank. See "transition" items below for additional requirements.
   b. Other Raceways Embedded inside Poured Concrete Walls, Ceilings or Floors (not meeting requirements above): Rigid Galvanized Steel or I.M.C. (coated with two (2) spiral-wrapped layers of 3M Scotchrap 50 PVC tape or two coats of asphaltum paint where below grade or within concrete).
   c. Other Raceways: E.M.T.
5. Terminations at motors, transformers and other equipment which has moving or vibrating parts:
   a. Exterior or Wet Locations (including, but not limited to, Pump Rooms, Wet Wells, Underground Vaults, and other similar locations): Liquidtight Flexible Metallic Conduit (shall generally not exceed 24 inches in length) with watertight fittings.
   b. Dry, Interior Locations: Flexible Metallic Conduit (shall generally not exceed 24 inches in length).
6. Terminations at fixtures mounted in grid-type ceilings:
   a. Flexible Metallic Conduit or MC cabling (shall generally not exceed 72 inches in length and shall run from junction box to fixture, not from fixture to fixture).
7. Transition from underground or concrete-encased to exposed:
   a. Convert PVC to Rigid Galvanized Steel (coated with two (2) spiral-wrapped layers of 3M Scotchrap 50 PVC tape or two coats of asphaltum paint where below grade or within concrete) utilizing Rigid Galvanized Steel 90 degree bends (and vertical conduits as required by application) prior to exiting concrete/grade (except at outdoor pull boxes and under freestanding electrical equipment, where terminations shall be by PVC end bells installed flush with top of slab). Exposed portions of these coated conduits shall extend a minimum of 6" above floor level, and shall be installed at uniform heights.

3.2 RACEWAY INSTALLATION

A. General:
1. Follow methods which are appropriate and approved for the location and conditions involved. Where not otherwise shown, specified, or approved in a particular case, run all wiring concealed.
2. Where conduit crosses a structural expansion joint an approved conduit expansion fitting shall be installed.
3. A non-conductive polypropylene pull string, properly tied/secured at either end, shall be installed in all empty conduits.
4. Metal conduit field-cuts shall be cut square with a hacksaw and the ends reamed after threading.
5. PVC conduit field-cuts shall be made with hacksaw, and ends shall be deburred.

6. All PVC joints shall be made as follows:
   a. Clean the outside of the conduit to depth of the socket, and the inside of socket with an approved cleaner.
   b. Apply solvent cement as recommended by the conduit manufacturer to the interior of the socket and exterior of conduit, making sure to coat all surfaces to be joined.
   c. Insert conduit into the socket and rotate 1/4 to 1/2 turn and allow to dry.
7. All metallic conduit installed below grade or within concrete shall be coated with two (2) spiral-wrapped layers of 3M Scotchrap 50 PVC tape or two coats of asphaltum paint prior to installation.
8. Install ground wire sized per N.E.C. Table 250.122 in all conduits.
9. Use of running threads is absolutely prohibited. Conduit shall be jointed with approved threaded conduit couplings. Threadless and clamp type not acceptable.
10. Conduits shall be sized in accordance with latest National Electrical Code except when size shown on drawings. 1/2-inch conduit shall not contain conductors larger than No. 12 or more than four (4) No. 12 conductors.
11. Exposed, field-cut threads on all metal conduits shall be painted with zinc primer (for Galvanized Rigid or I.M.C.) .

B. Routing/Locating:
1. Exposed conduit runs shall be run level and plumb and shall, on interior of buildings, be run parallel and/or at right angles to building walls and/or partitions.
2. Conduit with an external diameter larger than 1/3 the thickness of a concrete slab shall not be placed in the slab. Conduits in slab shall not be spaced closer than 3 diameters on center.
3. Conduit run in ceiling spaces shall be run as high as possible, all at same level, and shall be supported from building structure. Do not support conduit from any other installation.
4. Conduit run within exterior CMU, concrete or other similar walls shall be run within the CMU cells / concrete structure / etc. Conduits shall not be run on the outside surface of CMU cells / concrete structure / etc. underneath exterior veneers / etc., which could cause a thermal break in the wall insulation or a future water intrusion problem.
5. Install conduit runs to avoid proximity to steam or hot water pipes. In no place shall a conduit be run within 6” of such pipes except where crossing is unavoidable, then conduit shall be kept at least 3” from the covering of the pipe crossed.
6. Before installing raceways for motors, HVAC equipment and other fixed equipment, check location of all equipment connections/terminal boxes with equipment supplier and locate and arrange raceways appropriately.
7. A minimum of 12” of clearance (or more as required by associated utility companies) shall be provided between the finished lines of exterior, underground conduit runs and exterior, underground utilities (gas, water, sewer, etc.).
8. Where any portion of raceway is installed in a wet environment (such as below grade) and located at a higher elevation than the raceway termination point in a dry environment, install watertight compound inside raceway at termination around cabling to prevent transfer of water through conduit system. Watertight compound shall be rated for the potential water head pressure, based on the assumption that ground water level would be at grade level.

C. Bends:
1. Do not make bends (in any raceway, including flexible conduits) that exceed allowable conductor bending radius of cable to be installed or that significantly restrict conductor flexibility.

2. All bends within concrete-encased ductbanks installed in exterior locations shall be long radius bends (24" minimum bending radius – varies with conduit diameter).
3. Where numerous exposed bends or grouped together, all bends shall be parallel, with same center and shall be similar in appearance
4. All PVC elbows, bends, etc., shall be either factory bends or made with an approved heat bender.

D. Support:
1. Anchor conduit securely in place by means of approved conduit clamps, hangers, supports and fastenings. Arrangement and methods of fastening all conduits shall be subject to Engineer's direction and approval. All conduits shall be rigidly supported (wire supports may not be used in any location). Use only approved clamps on exposed conduit.
2. Conduit in riser shafts shall be supported at each floor level by approved clamp hangers.
3. Right angle beam clamps and U bolts shall be specially formed and sized to snugly fit the outside diameters of conduits.
4. Where installed in seismic zones, suspended raceways shall be braced in two (2) directions as required to prevent swaying and excessive movement.
5. Raceways installed on top of flat roofing shall be supported a minimum of 3 ½" above roof with rubber block supports (Cooper B-Line Dura-Blok or equal). Installation shall be in strict accordance with support manufacturer's instructions and recommendations.

E. Terminations:
1. All conduit connections to sheet metal cabinets or enclosures located in exterior or wet locations shall terminate by use of rain tight (Meyers) hubs.
2. Where rigid or I.M.C. conduits enter sheet metal boxes, they shall be secured by approved lock nuts and bushings.
3. Where metal conduits enter outdoor pull boxes, manholes, under freestanding electrical equipment or other locations where direct metal-to-metal contact does not exist between enclosure and conduit, grounding bushings shall be installed. Each grounding bushing shall be connected to the enclosure ground and all other grounding bushings with properly sized grounding conductors.
4. Where E.M.T. enters sheet metal boxes they shall be secured in place with approved insulating fittings.
5. Where PVC enters outdoor pull boxes, manholes or under freestanding electrical equipment, PVC end bells shall be installed.
6. Contractor shall be responsible for coordinating required conduit sizes with equipment hubs/conduit entry provisions (such as at motor tap boxes) prior to installation of conduit systems. Contractor shall field adjust final conduit sizes at terminations where so required (only as allowed by code) from those indicated on plans to coordinate with equipment hubs/conduit entry provisions.
7. Where conduit terminates in free air such that associated cabling/circuitry becomes exposed (such as at cable trays, etc.), conduit shall generally terminate in a horizontal orientation (to prevent dust/debris/etc. from entering conduit system). Where vertical conduit termination is necessary, the termination shall be provided with cord-grip conduit terminations to seal the conduit system.
8. Conduit ends shall be carefully plugged during construction.
9. Permanent, removable caps or plugs shall be installed on each end of all empty raceways with fittings listed to prevent water and other foreign matter from entering the conduit system.

F. Penetrations:
1. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly. Refer to drawings and other specifications for additional requirements.
2. All penetrations shall be at right angles unless shown otherwise.
3. Structural members (including footings and beams) shall not be notched or penetrated for the installation of electrical raceways unless noted otherwise without specific approval of the structural engineer.
4. Dry-packed non-shrink grout or watertight seal devices shall be used to seal openings around conduits at all penetrations through concrete walls, ceilings or aboveground floors.
5. All raceways entering structures, or where water is otherwise capable of entering equipment/devices through the raceway system, shall be sealed (at the first box or outlet) with foam duct sealant to prevent the entrance of gases or liquids from one area to another or into equipment/devices.
   a. Where the elevation of the raceway penetration (into the structure) is no more than 15' below the other (higher) end of the same raceway, Polywater FST sealant (rated to hold back up to 22' of continuous water head pressure), or pre-approved equal, shall be used.
   b. Where the elevation of the raceway penetration (into the structure) is between 15' and 75' below the other (higher) end of the same raceway, Polywater PHRD Custom Mechanical Seals (rated to hold back up to 36psi or 83' of continuous water head pressure), or pre-approved equal, shall be used.
   c. Where the elevation of the raceway penetration (into the structure) is more than 75' below the other (higher) end of the same raceway, the contractor shall propose a custom solution designed to hold back or to drain the possible water within the associated raceway. Submittals shall be provided to the engineer for review/approval, including a summary of the anticipated elevations/PSIs, details of the proposed installation, cut-sheets of devices/materials, etc.
6. Additionally, where necessary to ensure that water does not enter equipment/devices through the raceway system (where raceways extend to equipment/devices from wet areas), junction boxes with drain assemblies in bottom shall be located at low point of raceway system near equipment/devices (to drain water out of raceway system before it enters equipment/devices). Contractors shall provide drains in raceway systems where so necessary to prevent water entry into equipment/devices.
7. All raceways passing through concrete roofs or membrane-waterproofed walls or floors shall be provided with watertight seals as follows:
   a. Where ducts are concrete encased on one side: Install watertight entrance seal device on the accessible side of roof/wall/floor as directed by equipment manufacturer.
   b. Where ducts are accessible on both sides: Install watertight entrance seal device on each side of roof/wall/floor as directed by equipment manufacturer.
8. All raceways passing through walls of rooms containing/storing noxious chemicals (chlorine, ammonia, etc.) or through hazardous locations shall be sealed with conduit seals (Crouse-Hinds type EYS or equal).
9. All raceways terminating into electrical enclosures/devices/panels/etc. located in hazardous locations shall be sealed with conduit seals (Crouse-Hinds type EYS, EZS or equal) within 18" of the termination.

G. Exterior Electrical Ductbanks:
1. Where exterior electrical concrete-encased ductbanks are indicated on drawings, conduit runs between buildings or structures shall be grouped in concrete-encased ductbanks as follows:

a. A minimum of 3" of concrete shall encase each side of all ductbanks.
b. A minimum of 1 ½" of separation shall be provided between each conduit within ductbanks. PVC spacers shall be installed at the necessary intervals prior to placement of concrete to maintain the required spacing and to prevent bending or displacement of the conduits.
c. Top of concrete shall be a minimum of 30" below grade. A continuous magnetic marking tape shall be buried directly above each ductbank, 12" below grade.
d. Exact routing of ductbanks shall be field verified and shall be modified as necessary to avoid obstruction or conflicts.
e. Underground electrical raceways shall be installed to meet the minimum cover requirements listed in NEC Table 300.5. Refer to drawings for more stringent requirements.

END OF SECTION 26 05 33

SECTION 26 05 34

OUTLET BOXES, JUNCTION BOXES, WIREWAYS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Outlet and Junction Boxes

B. Pull Boxes

C. Wireways

PART 2 - PRODUCTS

2.1 OUTLET BOXES & JUNCTION BOXES (THROUGH 4-11/16")

A. Sheet Metal: Shall be standard type with knockouts made of hot dipped galvanized steel as manufactured by Steel City, Raco, Appleton, Bowers or equal.

B. Cast: Shall be type FS, FD, JB, GS, or SEH as required for application as manufactured by O-Z/Gedney, Appleton, or equal.

C. Nonmetallic: Shall be type Polycarbonate/ABS construction as required for application with non-metallic quick-release latches as manufactured by Hoffman, O-Z/Gedney, Appleton, or equal.

2.2 JUNCTION AND PULL BOXES (LARGER THAN 4-11/16")

A. Oil-Tight JIC: Shall be Hoffman Type CH box or approved equal.

B. Galvanized Cast Iron or Cast Aluminum: Shall be O-Z/Gedney or approved equal.

C. Stainless Steel: Shall be as manufactured by O-Z/Gedney, Hoffman or approved equal. Boxes shall have continuous hinges, seamless foam-in-place gaskets and screw-down clamps.

D. Nonmetallic: Shall be type Polycarbonate/ABS construction as required for application with non-metallic quick-release latches as manufactured by Hoffman, O-Z/Gedney, Appleton, or equal. Boxes shall have hinged covers and screw-down clamps.

E. Wireways: Shall be standard manufacturer's item as manufactured by Hoffman, Square "D", Burns, B & C or equal. Wireways shall have hinged covers and screw-down clamps.

F. Pre-cast Polymer Concrete Below-Grade Hand Holes & Pull Boxes:
1. Enclosures, boxes and cover are required to be UL Listed and conform to all test provisions of ANSI/SCTE 77 "Specifications For Underground Enclosure Integrity" for Tier 15 applications (15,000lb design load and 22,500lb test load) unless noted otherwise.
2. All covers shall have a minimum coefficient of friction of 0.05 in accordance with ASTM C1028 and the corresponding Tier level shall be embossed on the top surface.

3. Cover shall be bolt-down include factory-labeling to read “Electric”, “Communications” or other as directed.
4. Hardware shall be stainless steel.
5. Shall be Quazite PG/LG Style or approved equal.

G. Galvanized Cast Iron Below-Grade Pull Boxes:
1. Enclosures, boxes and cover are required to conform to AASHTO H-20 requirements for deliberate vehicular traffic applications unless noted otherwise.
2. Cover shall be checkered, bolt-down include factory-labeling to read “Electric”, “Communications” or other as directed.
3. Hardware shall be stainless steel.
4. Shall be furnished with grounding kit.
5. Shall be O-Z/Gedney Type YR or approved equal.
   a.

PART 3 - EXECUTION

3.1 APPLICATION

A. General
1. All boxes and wireways shall be of sufficient size to provide free space for all enclosed conductors per NEC requirements. Fill calculations shall be performed by contractor per NEC requirements.

B. Outlet Boxes & Junction Boxes (through 4-11/16”)
1. Sheet metal boxes shall be used on concealed work in ceiling or walls and exposed work in dry, interior locations
   a. Exception: Where exposed and installed within finished/public spaces such as offices, corridors, lobbies, etc., cast boxes shall be used for wiring device outlets. Cast boxes are not required in back-of-house areas such as electrical rooms, mechanical rooms, etc. .
2. Cast boxes shall be used wherever Rigid or I.M.C. conduits are installed.
3. All boxes installed in extremely corrosive areas (such as chlorine and fluoride storage rooms) where non-metallic raceways are used shall be non-metallic.
4. Except when located in exposed concrete block, switch and receptacle boxes shall be 4" square for single gang installation. Appropriate gang boxes shall be used for mounting ganged switches.
5. When installed in exposed concrete block, switch and receptacle boxes shall be square type designed for exposed block installation.
6. Ceiling outlet boxes shall be 4" octagon 1-1/2" deep or larger required due to number of wires.
7. Boxes installed in hazardous locations shall be explosion-proof rated for the associated application, constructed of copper-free cast aluminum.

C. Junction & Pull Boxes (larger than 4-11/16”)
1. For all below grade exterior use and elsewhere as shown:
   a. In areas subject to future vehicular traffic: shall be galvanized cast iron (rated AASHTO H-20 Loading unless noted otherwise).

b. In areas not subject to vehicular traffic: shall be galvanized cast iron or pre-cast polymer concrete (rated for Tier 15 Loading unless noted otherwise).

2. All boxes installed exposed in exterior or wet areas shall be powder-coated galvanized steel (NEMA 3R).
3. All boxes installed exposed in corrosive areas shall be stainless steel (NEMA 4X).
4. All boxes installed in extremely corrosive areas (such as chlorine and fluoride storage rooms) where non-metallic raceways are used shall be non-metallic.
5. Boxes installed in hazardous locations shall be explosion-proof rated for the associated application, constructed of copper-free cast aluminum.
6. All others shall be oil tight JIC box not less than 16 gauge.

3.2 INSTALLATION

A. General
1. All boxes and wireways shall be securely anchored.
2. All boxes shall be properly sealed and protected during construction and shall be cleaned of all foreign matter before conductors are installed.
3. All boxes and wireways shall be readily accessible. Contractor shall be responsible for furnishing and installing access panels per architect's specifications. Locations shall be as directed by the architect as required to make boxes, wireways, electrical connections, etc. accessible where above gypsum board ceilings or in other similar locations.
4. All metallic boxes and wireways shall be properly grounded.
5. Refer to Specification Section 26 05 53 for identification requirements.

B. Outlet Boxes & Junction Boxes (through 4-11/16")
1. Boxes shall be provided with approved 3/8" fixture studs were required.
2. Recessed boxes for wiring devices, surface fixtures, or connections, shall be set so that the edge of cover comes flush with finished surface.
3. There shall be no more knockouts opened in any sheet metal box than actually used.
4. Any unused opening in cast boxes shall be plugged.
5. Back to back boxes to be staggered at least 3 inches.
6. Under no circumstances shall through-the-wall boxes be used.

C. Junction & Pull Boxes (larger than 4-11/16")
1. Pull boxes shall be installed as indicated on plans and/or as required due to number of bends, distance or pulling conditions.
2. Boxes to be imbedded in concrete shall be properly leveled and anchored in place before the concrete is poured.
3. All pull boxes and/or junction boxes installed exterior below grade, shall have their tops a minimum of 1-1/2 inches above surrounding grade and sloped so that water will not stand on lid. A positive drain shall be installed, to prevent water accumulation inside.
4. Above grade pull boxes shall be installed on concrete anchor bases as shown on Plans.

D. Wireways and/or wall-mounted equipment
1. Mount each wireway to channels of the same metal type as the wireway.
2. Conductors serving a wireway shall be extended without reduction in size, for the entire length of the wireway. Tap-offs to switches and other items served by the wireway shall be made with ILSCO type GTA with GTC cap.

END OF SECTION 26 05 34

SECTION 26 05 36

CABLE TRAYS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, tests and services to install complete cable tray systems as shown on the drawings.

B. Cable tray systems are defined to include, but are not limited to straight sections of cable trays, bends, tees, elbows, drop-outs, supports and accessories.

1.2 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code

B. ASTM A123 - Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip

C. ASTM A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality

D. ASTM A1011 - Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High Strength Low Alloy with Improved Formability *(Formerly ASTM A570 &A607)*

E. ASTM A1008 – Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability *(Formerly ASTM A611)*

F. ASTM B633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel

G. NEMA VE 1-2002 - Metallic Cable Tray Systems

H. NEMA VE 2-2006 - Cable Tray Installation Guidelines

I. TIA 569-A – Commercial Building Standard for Telecommunications Pathways & Spaces

1.3 DRAWINGS

A. The drawings, which constitute a part of these specifications, indicate the general route of the cable tray systems. Data presented on these drawings are as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification, of all dimensions, routing, etc., is directed.

B. Specifications and drawings are for assistance and guidance, but exact routing, locations, distances and levels will be governed by actual field conditions. Contractor is directed to make field surveys as part of his work prior to submitting system layout drawings.

1.4 SUBMITTALS

A. Submittal Drawings: Submit drawings of cable tray and accessories including clamps, brackets, hanger rods, splice plate connectors, expansion joint assemblies, and fittings, showing accurately scaled components.

B. Product Data: Submit manufacturer's data on cable tray including, but not limited to, types, materials, finishes, rung spacings, inside load depths and fitting radii. For side rails and rungs, submit cross sectional properties including Section Modulus (Sx) and Moment of Inertia (Ix).

1.5 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of cable trays and fittings of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Provide cable trays and accessories through one source from a single manufacturer.

C. NEMA Compliance: Comply with NEMA Standards Publication Number VE1, "Cable Tray Systems".

D. NEC Compliance: Comply with NEC, as applicable to construction and installation of cable tray and cable channel systems (Article 318, NEC).

E. UL Compliance: Provide products that are UL-classified and labeled in their final installed form.

F. NFPA Compliance: Comply with NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance" pertaining to installation of cable tray systems.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver cable tray systems and components carefully to avoid breakage, denting and scoring finishes. Do not install damaged equipment.

B. Store cable trays and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials should be unpacked and dried before storage.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Wire Mesh Basket type cable tray systems:
1. Subject to compliance with these specifications, wire mesh basket type cable tray systems shall be as manufactured by Eaton B-Line, Inc.; Mono-Systems, Inc, Chalfant or Legrand Cablofil.

2.2 CABLE TRAY SECTIONS AND COMPONENTS

A. Typical Cable Tray Application (applicable unless noted otherwise on plans):

1. Containing only low voltage cabling AND concealed above accessible ceilings, below raised access floors or within telecommunications rooms: Wire mesh basket type with:
   a. Useable Loading Depth: 4".
   b. Minimum Load Rating: NEMA 12C.
   c. Material: Black powder coat painted steel.
   d. Width(s): as shown on plans.
2. All other applications: Ladder-type with:
   a. Rung Spacing:9" o.c.
   b. Useable Loading Depth: 4".
   c. Minimum Load Rating: NEMA 12C.
   d. Material: Aluminum.
   e. Width(s): as shown on plans.

B. General: Except as otherwise indicated, provide metal cable trays, of types, classes and sizes indicated; with clamp assemblies, connector/splice plates, splice bars, bolts, nuts and washers for connecting units as required. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards.

C. Cable tray construction:
1. Wire Mesh Basket type cable tray systems:
   a. All straight section longitudinal wires shall be constructed with a continuous top wire safety edge. Safety edge must be kinked and T-welded on all tray sizes.
   b. Wire mesh basket type cable tray shall be made of high strength steel wires and formed into a standard 2 inch by 4 inch wire mesh pattern with intersecting wires welded together. Minimum wire diameter shall be 5mm (4.5mm for stainless steel). All mesh sections must have at least one bottom longitudinal wire along entire length of straight section.
   c. All fittings shall be factory-built or shall be formed from straight sections in accordance with manufacturer's instructions to maintain the UL Classification of the system.

D. Materials and Finish: Specific material and finish types for each tray type (as specified elsewhere) shall comply with the following general requirements:
1. Aluminum: All sections and fitting side rails and rungs shall be extruded from Aluminum Association Alloy 6063. All fabricated parts shall be made from Aluminum Association Alloy 5052.
2. Pre-galvanized Steel: All sections, fitting side rails, rungs, and covers shall be made from steel meeting the minimum mechanical properties and mill galvanized in accordance with ASTM A653 SS, Grade 33, coating designation G90.
3. Hot-dip Galvanized Steel: All sections and fitting side rails and rungs shall be made from steel meeting the minimum mechanical properties of ASTM A1011 SS, Grade 33 for 14 gauge and heavier, ASTM A1008, Grade 33, Type 2 for 16 gauge and lighter and ASTMA510, Grade 1008 for wire mesh basket type, and shall be hot-dip galvanized after fabrication in accordance with ASTM A123. All covers and splice plates must also be hot-dip galvanized after fabrication; mill galvanized covers are not acceptable for hot-dipped galvanized cable tray. All hot-dip galvanized after fabrication steel cable trays must be returned to point of manufacture after coating for inspection and removal of all icicles and excess zinc. Failure to do so can cause damage to cables and/or injury to installers.
4. Stainless Steel: All sections, accessories and fitting side rails and rungs shall be made of AISI Type 316 stainless steel. Transverse members (rungs) or corrugated bottoms shall be

welded to the side rails with Type 316 stainless steel welding wire. Wire mesh basket type shall meet minimum mechanical properties of ASTM A580.

5. Black Powder Coated steel: All sections/components shall be powder coated black with an average paint thickness of 1.2mils (30microns) to 3.0mils (75microns).

E. Accessories and Supports:

1. General:
   a. Cable Tray Supports: Shall be placed so that the support spans do not exceed maximum spans allowed to achieve the specified cable tray load ratings.
   b. Center hung supports shall be manufactured of 12 gauge, 1-5/8 inch by 1-5/8 inch B-Line B22 steel strut with a pipe welded at the middle of the support to provide eccentric loading stability. Support shall withstand 700 pounds in a 60 percent vs. 40 percent eccentric loading condition with a safety factor of 3.
   c. Accessories - special accessories shall be furnished as required to protect, support, and install a cable tray system. Accessories shall consist of but are not limited to; section splice plates, expansion plates, blind-end plates, specially designed ladder dropouts, barriers, conduit-to-tray adapters, etc.
2. Wire Mesh Basket type cable tray systems:
   a. Barrier Strips: Shall be provided where specified on plans or where cables/conductors of varying voltage classes are installed within the same tray (per NEC requirements), shall be manufactured by the tray system supplier and shall be fastened into the tray as directed by the tray system supplier.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Installers of wire mesh basket type cable tray systems shall be certified by the supplier of the cable tray system.
2. Install cable trays as indicated: Installation shall be in accordance with:
   a. Equipment manufacturer's instructions.
   b. Recognized industry practices.
   c. NEC (Article 392 and others).
   d. Applicable portions of NFPA 70B.
   e. NEMA-VE2.
3. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the owner or owner’s representative.
4. Coordinate cable tray installation with other work as necessary to properly interface installation of cable tray with other work.

B. Cabling:

1. All cabling/conductors routed in cable tray shall be rated for cable tray application.
2. Cabling/conductors of varying voltage classes installed within common trays shall be separated by barrier strips per NEC requirements.
3. Cable/conductor securing:
   a. Cables/conductors shall be secured to the transverse elements of the associated trays at the following minimum intervals:

1) Seismic, high-shock or vibration prone areas (such as mechanical rooms, process areas, etc.):
   a) All cables/conductors: 24".
2) Non-horizontal cable tray sections:
   a) All cables/conductors: 36".
3) Horizontal cable tray sections:
   a) All power cables/conductors: 36"
   b) Control, instrumentation and network cables in cable trays in exposed areas: 36"
   c) Control, instrumentation and network cables in cable trays in concealed interior areas (such as above lay-in ceilings): No cable ties required.

b. All cable ties used to secure cables to trays in interior areas shall be plenum-rated plastic. Cable ties used in interior exposed areas (subject to light) in interior areas shall be sunlight/UV-resistant. Cable ties used in exterior environments shall be of non-magnetic stainless steel construction.

4. Cable/conductor arrangement:
   a. Provide separation between power cables/conductors within cable trays for proper heat dissipation (and conductor ampacity ratings) per NEC requirements.

C. Bonding:
1. Ground and bond metal cable tray in accordance with NEC Articles 392, 250.96 and 250.102.
   a. Provide continuity between all metal cable tray components.
   b. Make connections to tray using mechanical, compression or exothermic connectors.
2. Cable trays shall be properly bonded with grounding harnesses or other necessary equipment as required to all metal conduits terminating into the cable trays and between cable tray sections.

D. Location/Routing:
1. Location of cable tray shown on plans is for general routing only. Field coordinate exact cable tray locations/routing with all piping, equipment, ductwork, structure, lighting, etc. & other trades prior to ordering cable tray. Provide vertical & horizontal bends as required, maintaining proper clearance around cable trays.
2. Coordinate cable tray with all other work as necessary to properly integrate installation of cable tray work with other work. Any potential conflicts between locations of cable trays and locations of other items shall promptly be brought to the attention of the engineer prior to installation.
3. Provide a minimum of 6" clearance on top of cable trays and 3" clearance on bottom and sides of cable trays to permit access for installing and maintaining cables unless specifically approved or directed otherwise by engineer.

E. Support:
1. Cable tray fitting supports shall be located such that they meet the strength requirements of straight sections. Install fitting supports per NEMA VE-2 guidelines, or in accordance with manufacturer's instructions.
2. Trapeze hangers and center-hung supports shall be supported by 1/2 inch (minimum) diameter all-thread rods unless noted otherwise. Trapeze hangers supporting wire mesh basket type cable trays 12" wide or less may be supported by 3/8 inch (minimum) diameter all-thread rods.

F. Penetrations:
1. Where cable trays pathways pass through walls, floors, ceilings or other similar partitions that are fire-rated, smoke-rated, designed to prevent water entry, designed to limit sound transmission, or designed to limit air passage (for environmental or conditioning purposes), cable trays themselves shall not penetrate the partition but shall be terminated on either side of the partition. The partition shall be penetrated with conduit sleeves sealed with suitable fire caulk or other approved material, per specific instructions of the caulk supplier to maintain partition/etc. ratings (such as fire or smoke ratings), after installation of all cabling. Bonding jumpers shall be provided through sleeves to ensure electrical continuity of cable tray system. Interior cross-sectional area of the conduit sleeves shall match or exceed the interior cross-sectional area of the associated cable tray(s).
2. Contractor shall verify arrangement, sizes and locations of all penetrations through load-bearing walls, floors or other structural items with structural engineer. Contractor shall submit sketch of proposed sleeve locations to structural engineer for review prior to rough-in.

G. Marking:
1. Cable trays containing conductors rated over 600 volts shall have a permanent, legible warning notices installed per NEC 392 requirements.

3.2 TESTING

A. Test cable trays to ensure electrical continuity of bonding and grounding connections. See NFPA 70B, Chapter 18, for testing and test methods.

B. Manufacturer shall provide test reports witnessed by an independent testing laboratory of the "worst case" loading conditions outlined in this specification and performed in accordance with the latest revision of NEMA VE-1; including test reports verifying rung load capacity in accordance with NEMA VE-1 Section 5.4.

END OF SECTION 26 05 36

SECTION 26 05 53

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Wire and cable identification.

B. Pullbox & Junction Box Identification

C. Electrical distribution & utilization equipment identification.

D. Emergency and Standby Power receptacle identification.

PART 2 - PRODUCTS

2.1 WIRE AND CABLE IDENTIFICATION

A. Intermediate Locations:
1. Wires and cable labels shall be white, thermal transfer, halogen-free, flame-retardant marker plates (sized to accommodate three lines of text) permanently affixed to the associated cable with UV-resistant plastic wire ties. Labels shall be Panduit #M200X/300X series or equal.

B. Circuit/Cable Termination Locations:
1. Wires and cable labels shall be non-ferrous identifying tags or pressure sensitive labels unless noted otherwise.

2.2 ELECTRICAL DISTRIBUTION & UTILIZATION EQUIPMENT IDENTIFICATION

A. Labels on electrical distribution & utilization equipment shall be black-on-white engraved Bakelite nameplates permanently affixed to the equipment with rivets or silicone adhesive unless noted otherwise.

B. Labels on electrical distribution equipment fed from emergency or legally-required standby sources (such as emergency generators) shall be white-on-red engraved Bakelite nameplates permanently affixed to the equipment with rivets or silicone adhesive.

2.3 EMERGENCY AND STANDBY POWER RECEPTACLE IDENTIFICATION

A. Receptacles fed from emergency or standby power sources (such as emergency generators) shall be provided with factory-marked engraved coverplates as follows:
1. Emergency System source: Red engraved lettering to read “EMERGENCY”.
2. Legally-Required or Optional Standby Generator source:
   a. If only part of facility is fed with generator backup: Black engraved lettering to read “FED FROM GENERATOR”.
   b. If entire facility is fed with generator backup: No “….GENERATOR…” label required.

PART 3 - EXECUTION

3.1 GENERAL

A. Any proposed deviation in identification methods and materials from those described herein shall be submitted to Architect for review and comment prior to installation.

B. Contractor shall provide all labeling or identification required by applicable local, state and national codes. These specifications do not intend to itemize all code-required labeling or identification requirements.

C. All labels/identification shall be positioned such as to be readable from the normal perspective without adjusting wiring/cables/labels. For example, labels/identification of wires/cables within cable trays shall be positioned to point towards the viewer (typically downward for overhead cable trays, or upward for cable trays within trenches).

D. All labels/identification (except for handwritten labels on concealed pullbox/junction box covers as noted below) shall be typewritten/printed/engraved in a neat, workmanlike, permanent, legible, consistent and meaningful manner. Labels shall not be handwritten unless specific approval is granted by engineer.

3.2 WIRE AND CABLE IDENTIFICATION

A. General:
1. Where cabling is exposed (such as within cable trays), provide two wire ties per cable (one on either end of marker plate to provide a flush installation). Where cabling is concealed (such as within pullboxes/wireways), one wire tie per cable will be acceptable.

B. Intermediate Locations:
1. Thermal transfer labels shall be securely fastened to all wiring and cabling in the following locations:
    a. Wireways
    b. Pullboxes/Junction boxes larger than 4-11/16”
    c. Pullboxes/Junction boxes through 4-11/16” where wires and cables are not easily identifiable via the color coding and box labeling
    d. Vaults & Manholes
    e. Approximately every 50 feet within cable trays (especially at locations where cables exit or diverge). Labels within cable trays shall be grouped (rather than being pre-labeled on cables and pulled into cable trays).
    f. Other similar intermediate locations.
2. Labels shall be stamped or printed with the following data so that the feeder or cable can be readily identified and traced:
    a. From where the circuit originates (including panel designation and circuit number):
        1) Ex: “FROM: PP-A CIR. 3 (IN MAIN ELEC ROOM)”
    b. To where the circuit extends (using the common name of the equipment):
        1) Ex: “TO: RTU-6 (ON ROOF)”
    c. The purpose of the circuit:
        1) Ex: “POWER”
    d. The set number (If parallel power feeds are used).
        1) Ex: “SET NO. 3 OF 4”

C. Circuit/Cable Termination Locations:
1. Where multiple termination points exist within a circuit origination point (panelboard, switchboard, MCC, starter, etc.) or other similar circuit endpoint (control panel, etc.), labels shall be securely fastened to all ungrounded and neutral conductors to clearly identify the terminal and/or circuit number associated with each conductor. For example, within lighting panels, each phase and neutral conductor shall be labeled near the terminals at a clearly visible location with the associated circuit number(s), so that if all conductors were unterminated, the labels would clearly indicate which conductor was associated with each circuit.

D. Refer to Specification Section 26 05 19 for all color-coding requirements of wires and cables.

3.3 PULLBOX & JUNCTION BOX IDENTIFICATION

A. Concealed pullboxes/junction boxes:
1. Front surface of all pullbox/junction box covers in concealed areas (such as above lay-in ceilings) or within mechanical/electrical rooms (and other similar areas where appearance of boxes is not an issue) shall be neatly marked with the ID of circuits/cables contained with permanent black marker on cover of box (Ex: “RP-1A Cir. 1, 2 & 3”). Additionally, front surface of box shall be painted red where box contains fire alarm system cabling.

B. Exposed pullboxes/junction boxes:
1. Interior surface of all pullbox/junction box covers in exposed areas shall be labeled “Power”, “Telecommunications”, “Fire Alarm” or with other similar general text neatly with permanent black marker to indicate function of box. Circuit/cable labeling within box (see above) shall identify specific cables contained. Additionally, interior surface of cover shall be painted red where box contains fire alarm system cabling.

C. Where pullboxes/junction boxes are named on contract documents (Ex:”PULLBOX #3”), an engraved nameplate shall be installed on the front surface of the box to identify the name.

3.4 ELECTRICAL DISTRIBUTION & UTILIZATION EQUIPMENT IDENTIFICATION

A. General:
1. All new and existing equipment modified by this project shall include arc-flash warning labels in accordance with NEC article 110.16.

B. All Panels, Motor Control Centers, Switchboards, Switchgear, Transformers, Etc.:
1. Engraved nameplates identifying name of equipment, nominal voltage and phase of the equipment and where the equipment is fed from shall be installed on front surface of all panels, motor control centers, switchboards, switchgear, transformers, etc.:
   a. Ex: First Line: “NAME: RP-A”, Second Line: “120/208V-3Ø-4W”, Third Line: “FED FROM: PP-A CIR. 4 (IN MAIN ELEC ROOM)”
2. Refer to Panelboard Specification Sections for additional labeling requirements (circuit directory cards, permanent circuit labels, permanent circuit numbers, etc.) required inside panelboards.

C. Safety/Disconnect Switches and Utilization Equipment (HVAC Equipment, Pumps, Powered Valves, Control Panels, Starters, Etc.)::
1. Engraved nameplates identifying equipment being fed and where the equipment is fed from shall be installed on front surface of all disconnect switches (including both visible blade

type switches and toggle-type switches) and on utilization equipment (where not clearly identified by immediately adjacent local disconnect switch):
   a. Ex: First Line: "RTU-6", Second Line: "FED FROM: PP-A CIR. 5"
2. Where safety/disconnect switches are installed on the load side of variable frequency drives, the safety/disconnect switch shall be furnished with an additional engraved nameplate to read: "WARNING: TURN OFF VFD PRIOR TO OPENING THIS SWITCH".
3. Safety/Disconnect switches feeding equipment that is fed from multiple sources (such as motors with integral overtemperature contacts that are monitored via a control system) and Utilization Equipment fed from multiple sources shall be furnished with an additional BLACK-ON-YELLOW engraved nameplate to read: "WARNING: ASSOCIATED EQUIPMENT FED FROM MULTIPLE SOURCES – DISCONNECT ALL SOURCES PRIOR TO OPENING COVER".

D. Emergency Systems:
1. A sign shall be placed at the service entrance equipment (and at any remote shunt trip operators, or similar, for service equipment) indicating the type and location of on-site emergency power sources (such as generators, central battery systems, etc.) per NEC requirements.
2. All boxes and enclosures (including transfer switches, generators, power panels, junction boxes, pullboxes, etc.) dedicated for emergency circuits shall be permanently marked with white-on-red engraved nameplates so they will be readily identified as a component of an emergency circuit or system.
3. Where an Essential Electrical System (EES) is installed, all enclosures, raceways and equipment that are components of the EES shall be readily identified as such. Raceway shall be identified at intervals not exceeding 25 ft.

E. Services:
1. All Service Equipment:
   a. Engraved nameplates identifying maximum available fault current, including date the fault current calculation was performed, in accordance with NEC article 110.24.
      1) Ex: First Line: "AVAILABLE FAULT CURRENT: 16,154 AMPS", Second Line: "DATE CALCULATED: JULY 8, 2013"
   b. All service entrance equipment shall be clearly labeled as being service entrance rated.
2. Where a building or structure is supplied by more than one service (or any combination of branch circuits, feeders and services), a permanent plaque or directory shall be installed at each service disconnect location denoting all other services, feeders & branch circuits supplying that building or structure and the area served by each, per NEC requirements.

F. Generators:
1. Generators shall be labeled with engraved nameplates identifying name of equipment.

3.5 EMERGENCY AND STANDBY POWER RECEPTACLE IDENTIFICATION

A. Receptacles fed from emergency or standby power sources (such as emergency generators) shall be provided with factory-marked engraved coverplates as described above.

3.6 OTHER IDENTIFICATION

A. Factory-engraved coverplates identifying functions of light switches and other similar devices shall be installed where so required by plans/specifications.

END OF SECTION 26 05 53

SECTION 26 09 43

LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.1 INTRODUCTION

A. The work covered in this section is subject to the requirements in the General Conditions of the Specifications. Contractor shall coordinate the work in this section with the trades covered in other sections of the specification to provide a complete and operable system.

1.2 SYSTEM DESCRIPTION

A. Extent of lighting control system work is indicated by drawings and by the requirements of this section. Contractor shall furnish and install a complete, integrated, stand alone automatic lighting control system including programmable Lighting Control Panels with internal astronomic timeclock(s), Networking between panels, Dataline low voltage control switch inputs for zone control, Photocell input for outdoor lighting control, Occupancy Sensors, and Daylighting Controls from a single supplier. Contractor is responsible for confirming that the panels and sensors interoperate as a single system.

1.3 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Comply with NEC, NEMA, and FCC Emission requirements for Class A applications.

C. UL Approvals: Relay panels and accessory devices are to be UL listed under UL 916 Energy Management Equipment. Configured to order or custom relay panels shall be UL Listed under UL 508, Industrial Control Panels.

1.4 SUBMITTALS

A. Submittals Package: Submit the shop drawings, and the product data specified below at the same time as a package.
   1. Shop Drawings: Building floorplans showing all proposed devices and composite wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted).
   2. Product Data: Catalog sheets, specifications and installation instructions.

1.5 APPROVED MANUFACTURERS

A. Watt Stopper/Legrand – Lighting Integrator series

B. Equal by Acuity Lighting

C. Any other system wishing to be considered must submit descriptive information 10 days prior to bid. Prior approval does not guarantee final approval by the electrical engineer. The contractor shall be completely responsible for providing a system meeting this specification in its entirety.

All deviations from this specification must be listed and individually signed off by the consultant.

PART 2 - PRODUCTS

2.1 LIGHTING CONTROL PANELS

A. Provide lighting control panels in the locations and capacities as indicated on the plans and schedules. Each panel shall be of modular construction and consist of the following components:

1. Enclosure/Tub shall be NEMA 1, NEMA 3R, or NEMA 4 as indicated on the plans, sized to accept an interior with 1-8 relays, 1-24 relays and six (6) four pole contactors, or 1-48 relays with six (6) four pole contactors, per enclosure. Multiple enclosures shall be provided where required for the specified quantities of relays/contactors.
2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. The panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. The interior construction shall provide total isolation of high voltage (class 1) wiring from low voltage (class 2) wiring within the assembled panel. The interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. The panel interiors shall include the following features:
    a. Provision for one or two optional control and automation cards.
    b. Removable, plug-in terminal blocks with screw less connections for all low voltage terminations.
    c. Individual terminal block, override push button, and LED status light for each relay
    d. Switch inputs associated with each relay and group channel shall support two or three wire, momentary or maintained contact switches or 24VDC input from occupancy sensors.
    e. Automatic support for occupancy sensor sequence of operation. Low voltage inputs automatically reconfigure when connected to a Watt Stopper occupancy sensor head. Occupancy sensor shall switch lighting on and off during unoccupied periods but shall not turn lighting off during scheduled occupancy periods.
    f. Isolated contacts within each relay shall provide true relay state to the electronics. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems.
    g. Automatic sequenced operation of relays reduces impact on the electrical distribution system when large loads are controlled simultaneously.
    h. Group, channel, and pattern control of relays shall be provided through a simple button-press interface within the panel. Any group of relays can be associated with a channel for direct on/off control or pattern (scene) control via a simple programming sequence using the relay and channel override push buttons and LED displays.
    i. Relay group status for each channel shall be provided through bi-color operation of the LED indicators. Solid red indicates that all relays in the group are on, solid green indicates that the group is in a mixed state, and blinking green indicates that the relays have blink warned and are currently timing out.

j. Each relay and channel terminal block shall provide a 24V pilot light signal. It shall be possible to configure the system for support for any Class 2 pilot light voltage with the use of an auxiliary power supply.
k. Single pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
   1) Electrical:
      a) 30 amp ballast at 277V
      b) 20 amp ballast at 347V
      c) 20 amp tungsten at 120V
      d) 30 amp resistive at 347V
      e) 1.5 HP motor at 120V
      f) Short circuit current capacity equal to (or greater than) that of the associated circuits (see associated panelboard schedules on drawings)
   2) Mechanical:
      a) Individually replaceable, ½" KO mounting with removable Class 2 wire harness
      b) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel
      c) Dual line and load terminals each support two #14 – #12 solid or stranded conductors
      d) Tested to 300,000 mechanical on/off cycles
   3) Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
l. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.

2.2 LONWORKS® BASED DIGITAL COMMUNICATIONS

A. The lighting control panel shall support digital communications to facilitate the extension of control to include multiple panels and other intelligent field devices. Digital communications shall be LonWorks® based and use the LonTalk® protocol in an open topology architecture.
   1. Dataline communications wire shall be 18 AWG, 4 unshielded copper conductors (two independent twisted pairs) meeting Class 2P NEC code requirements. The dataline shall be topology free and can be run in a serial, "T"or star configuration.
   2. The Dataline wire will be supplied by the equipment manufacturer and will include the manufacturers name, catalog number printed on the wire jacket. The contractor, at their own expense will, replace an improper dataline wire.
   3. Panels shall be digitally addressed and support bi-directional communication between each other and other intelligent field devices specified elsewhere.
   4. Intelligent field devices supported shall include digital dataline switches, network clock/programmer, telephone interface module, BMS interface module, photocell control module, programmable thermostat, and universal switch module.

2.3 BROWSER BASED PROGRAMMING AND CONTROL

A. The lighting control system shall include a web browser based user interface that shall allow programming and override of the system from any PC browser with network connectivity to the lighting controls. The Automation Appliance shall include as a minimum the following

features:

1. The interface shall be a TCP/IP based server device that is connected to the lighting control system global dataline and shall not require that software be installed on the client PC(s) for operation.
2. Provide support for connection of one or more personal computers directly via Ethernet or enterprise connectivity via a local area network, wide area network or internet connection.
3. Provide the option for a plug-in 56K baud modem to enable dial in connection via standard telephone line. All functionality of the browser interface shall be available through the dial-up connection.
4. Log in to the lighting control system through the browser interfaced shall provide multi-level security. Users shall be assigned log in access levels to restrict program modification to authorized users.
5. User programming shall include eight independent schedules for each lighting control panel, as well as, eight global schedules that affect channels in all panels on the network. Schedules shall overlap such that a panel specific schedule for any channel will override a global schedule for that channel.
6. Schedules shall be capable of seven day repeating and calendar date event based formats.
7. User programming shall be scenario based and shall include the following options:
   a. Scheduled ON / OFF
   b. Manual ON / Scheduled OFF
   c. Manual ON / Auto Sweep OFF (for AS-100 Switches)
   d. Astro ON / OFF (or Photo ON / OFF)
   e. Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
8. It shall be possible to view the status of and override any relay or channel group via the browser interface screens.
9. Provide support and user interface screens for integration of the photocontrol module, dataline switches, touch-tone telephone module, and universal switch module.
10. Provision for integration with the building automation system shall be via the industry standard BACnet protocol. Any of the eight global schedule channels shall individually be set to follow the BAS schedules rather than the internal Automation Appliance schedules. Relays in all panels shall be exposed to the BAS as binary output objects. It shall be possible for the BAS to read the status of each relay and to override each relay via BACnet.
11. The interface shall monitor all networked components and automatically generate alarms if any component fails to properly respond to control. Alarms shall be annunciated via the browser screens and via email to selected recipients where a proper SMTP server connection has been set up.
12. The user programming in the lighting control panels and dataline switches shall be available for viewing or download to the client PC as a standard PDF file.
13. A backup function shall permit the complete system program to be saved to the hard drive of any client PC connected to the lighting control system through the browser interface. A restore function shall allow a saved program to be reloaded to the interface.

2.4 EIGHT CHANNEL DIGITAL PHOTOCONTROL MODULE

A. Provide a weatherproof Class 2 photocell for measuring exterior light levels. The photocell shall be mounted facing north as indicated on the plans. The photocell shall be connected to a photocontrol module mounted on the DIN rail inside the low voltage section of a lighting control panel and connected to the dataline communications wire.

1. The photocontrol Module shall integrate seamlessly with either the Network Clock, Automation Appliance, or the BMS Interface Module. The control module shall measure the actual exterior light and display this level in foot candles (fc) on the unit LCD display.
2. The controller shall have eight individual set point adjustments that are available to the lighting control network over the dataline communications wire.
3. Features
   a. Real time, 2 line LCD display of actual exterior light level up to 200 fc.
   b. Channel set points and parameters programmed via the Network Clock or BMS Interface Module.
   c. Choice of OPERATE or TEST modes, with simulated light level for testing.
   d. Automatic dead band and 5 minute time delay to avoid cycling.

2.5 DIGITAL DATALINE SWITCHES

A. Intelligent digital switching shall be provided operating on the dual twisted pair communication wire. Switches shall be available in single, dual, quad, or octal (1-button, 2-button, 4-button, or 8-button) designs. The single, dual, and quad devices shall mount in a standard single-gang box, the octal version in a two-gang box.
   1. Each button shall be individually programmable. Programming of buttons shall not require the use of a computer or other programming device. It shall be possible to assign relays or channels to buttons using a simple button press interface. Each button can control any one of the following options:
      a. Any individual relay in any single panel.
      b. Any group of relays in any single panel.
      c. Any group of relays in the system (via network clock, Automation Appliance, or WinControl software package).
   2. For applications that require pattern switching, buttons shall function as a scene control using an ON/OFF/Not Controlled pattern of relays instead of the normal All ON/OFF.
   3. Switches shall be constructed of non-breakable grey Lexan on all exposed parts and shall include a stainless steel wall plate, unless noted otherwise on plans.
   4. Individual buttons shall have a removable clear cover to allow standard 9 mm (3/8 inch) labeling tape to be used to identify the controlled loads.
   5. Each switch shall use a bi-color LED pilot light for the individual buttons to indicate status of the controlled relay or group of relays. LED indications are Red for All ON, Green for Mixed State (some relays in the group ON and others OFF), and No LED for All OFF.
   6. Switch LED pilot lights shall flash green to indicate impending off sweep during the five-minute grace period following blink warning of the lights. Once the button is pressed, the LED will change to Red to acknowledge the occupant's override command to keep lights ON.
   7. Multiple dataline switches programmed to control the same relay or relay group shall indicate the same status automatically.
   8. Each switch shall also include a locator light illuminating the switch for easy location in the dark.
   9. The dual, quad, and octal switches shall all include a single master button that will override all relays controlled by the individual buttons OFF, or Restore them to their original state. Each switch's master button configuration can be altered to perform a Master ON/OFF, OFF Only, or Disabled function if desired.
   10. Switches can be configured to follow a "Cleaning" scenario. This specific scenario shall prevent the cleaners from overriding OFF any relays previously turned ON by an occupant.

11. Each switch is available in a Key lock override version. Once a key is inserted, the individual buttons will function for five minutes.

2.6 AUTOMATIC LIGHTING CONTROLS

A. System shall provide automatic lighting shutoff for all interior lighting circuits controlled by the system (excluding night lights and other similar circuits) per latest ASHRAE 90.1 & IECC standards, unless specifically shown otherwise on plans.

B. System shall provide blink-warnings for interior lighting circuits (excluding circuits with HID light fixtures) controlled by the control panel 5 minutes prior to automatic shutoff.

C. System shall include provisions for holiday scheduling, to allow automatic “ON” programming to be skipped on holidays and other scheduled off days per applicable energy code requirements.

D. Low voltage remote override switches shall be provided as shown on drawings.

E. Exact preset times for lighting control zone controls (where applicable) and lighting control system operation shall be per owner’s direction. Contractor shall submit a proposed lighting control schedule indicating type of “ON” control (occupancy, time-of-day, manual, etc.), type of “OFF” control (occupancy, time-of-day, manual, etc.) and proposed preset times for all zones to owner for review prior to implementation. The following general control schemes shall generally be used where the owner has no preferences unless shown otherwise on plans:
1. Exterior Security Lighting (at doorways, etc.):
    a. On: Photocell or Astronomic – dusk.
    b. Off: Photocell or Astronomic – dawn.
2. Other Exterior Lighting:
    a. On: Photocell or Astronomic – dusk.
    b. Off: Preset Time (as directed by the facility operator).
3. Interior Lighting with Occupancy Sensor Controls:
    a. Corridors, restrooms, lobbies and other similar public spaces
        1) On: Occupancy Sensor.
        2) Off: Occupancy Sensor.
    b. Storage rooms, janitor's closets, telecommunications rooms, and other similar unoccupied spaces:
        1) On: Occupancy Sensor.
        2) Off: Occupancy Sensor.
    c. Offices, classrooms, breakrooms, conference rooms, work areas, kitchens, gymnasiums, and other similar occupied spaces:
        1) On:
            a) Manual Local Switch (if digital controls are provided) or
            b) Occupancy Sensor (if hardwired controls are provided).
        2) Off: Occupancy Sensor (A "grace period" shall be provided, in which the occupancy sensor can turn lights back "on" for a short period of time (approximately 15 seconds) after lights are turned off automatically).
4. Interior Lighting with Time-of-Day Controls:
    a. Corridors, restrooms, lobbies and other similar public spaces
        1) On: Preset Time (as directed by the facility operator).
        2) Off: Preset Time (as directed by the facility operator).

b. Storage rooms, janitor's closets, telecommunications rooms, and other similar unoccupied spaces:
   1) On: Manual Local Switch
   2) Off: Preset Time (as directed by the facility operator).
c. Offices, classrooms, breakrooms, conference rooms, work areas, kitchens, gymnasiums, and other similar occupied spaces:
   1) On: Manual Local Switch
   2) Off: Preset Time (as directed by the facility operator).

2.7 WIRING

A. See Specification Section 27 05 00 for additional requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Specification Section 27 05 00 for additional cable installation requirements.

B. Master/centralized lighting control switches (particularly switches located in areas where not all associated lighting fixtures are visible from the switch) and individual buttons of other lighting control stations with more than two (2) buttons shall be labeled (on switch coverplate or directly on buttons) with factory-engraved labeling. Exact wording of labeling shall be per owner's direction unless shown otherwise on plans.

3.2 SUPPORT SERVICES

A. Pre-installation Coordination
1. Exact occupancy sensor and daylight sensor types and locations shall be determined by the lighting control system supplier for a fully-functional system with adequate coverage throughout areas controlled by occupancy sensors. Exact locations shall be coordinated with actual HVAC register locations, furniture/casework/etc. locations, sensor coverage patterns, etc. for proper coverage in all areas. In no case may fewer devices or lower-quality devices be used in each area than indicated on contract documents.

B. System Start Up and Commissioning
1. The electrical contractor shall provide the manufacturer, the facility owner and the electrical engineer with ten working days written notice of the system startup and adjustment date.
2. Manufacturer shall provide a factory authorized technician to confirm proper installation and operation of all lighting control system components. The startup requirement is intended to verify:
   a. That all occupancy and daylighting sensors are located, installed, and adjusted as intended by the factory and the contract documents.
   b. The occupancy sensors and daylighting sensors are operating within the manufacturers specifications.
   c. The sensors and relay panels interact as a complete and operational system to meet the design intent.
3. Manufacturer to provide a written statement verifying that the system meets the above requirements.

C. Re-commissioning – After 30 days from occupancy re-calibrate all preset times, sensor time

delays and sensitivities and relocate occupancy sensors if so required to meet the Owner's Project Requirements. Provide a detailed report to the Design Team and Owner of re-commissioning activity.

D. System Training
1. Manufacturer shall provide factory authorized technician to train owner personnel in the operation, programming and maintenance of the lighting control system including all occupancy sensors and daylighting controls.

E. System Programming
1. Manufacturer shall provide system programming including:
   a. Wiring documentation.
   b. Switch operation.
   c. Telephone overrides.
   d. Operating schedules.

3.3 WARRANTY

A. The contractor shall warrant the completed lighting control system to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the completed and certified test or from the date of first beneficial use.

END OF SECTION 26 09 43

SECTION 26 24 16

POWER PANELBOARDS - CIRCUIT BREAKER TYPE

PART 1 - GENERAL

1.1 GENERAL

A. The work under this section includes but is not limited to the following:
1. Power Panelboards
2. Power Circuit Breakers

PART 2 - PRODUCTS

2.1 PANELBOARDS - GENERAL

A. Panelboards shall be dead front type, having lugs only or circuit breaker in mains as shown in panelboard schedule with circuit breaker branches.

B. Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on plans. Such rating shall be established by heat rise test with Maximum hot spot temperature on any connector or bus bar not to exceed 50 degrees C rise above ambient at full rated load. Heat rise test shall be conducted in accordance with UL Standard UL67. Bus structure shall be tin-plated aluminum or tin-plated copper. All neutral busses shall be full size. All panelboards shall contain ground buss.

C. Entire panelboard assembly, including all bussing, shall have SCCR ratings meeting or exceeding the minimum AIC ratings listed on the plans for the panel. All ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.

D. Panelboards shall be listed by Underwriters Laboratories and shall bear the UL label. Panelboards shall be suitable for use as service equipment when required.

E. Top/bottom feed arrangement and lug sizes/quantities shall be coordinated by the contractor.

F. Service entrance panelboards shall be provided with barrier such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations**.**

2.2 CIRCUIT BREAKERS

A. Where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated (or can be adjusted to is 1200A or higher, breakers shall be electronic trip and shall be provided with arc energy-reducing maintenance switching (with local status indicator) to reduce arc flash energy per NEC 240.87 requirements.

B. Circuit breakers shall be quick-make and quick-break, whether actuated automatically or manually. Circuit breakers shall have inverse time tripping characteristics with automatic release which shall trip free of the handle. Circuit breaker handles shall be three distinct positions—“OFF”, “ON”, and “TRIPPED”. When a circuit breaker opens on overload or short

circuit, the operating handle shall automatically assume the "TRIPPED" position.

C. Multipole breakers shall be internal common trip with single operating handle. External handle ties are not acceptable, unless specifically noted otherwise (such as for multi-wire branch circuits described below).

D. Circuit breakers feeding multiwire branch circuits (as defined by NEC) consisting of separate single phase loads sharing a common neutral shall be provided with handle ties to simultaneously disconnect all ungrounded conductors per NEC Article 210.4(B). The necessary locations of these handle ties shall be coordinated by the contractor. Where necessary, the contractor may rearrange circuit breakers (as minimally as possible) as required to meet this requirement.

E. Circuit breakers shall be of the bolt-on type.

F. Circuit breakers shall be "FA" frame and larger.

G. All breakers shall meet the minimum RMS symmetrical interrupting capacity ratings shown on plans for the associated panel. All interrupting ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.

H. The front face of all circuit breakers shall be flush with each other. Breaker numbers shall be permanently attached to trim.

I. All branch circuit breakers shall be listed to UL489 or shall be specially-tested to be HACR listed.

2.3 CABINETS, TRIM AND WIREWAY SPACE

A. Clear space from bottom of lugs to bottom of wireway shall be not less than 6 inches for 400 amps and below, 10 inches for 600 amps, 12 inches for 800 amps and above.

B. Panelboard interiors shall be fastened to cabinets by adjustable aligning supports.

C. Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets.

D. Fronts of cabinets shall be made from a single sheet of full finished steel having the door cut out. Doors shall have flush hinges, and lock utilizing all metal construction (with all locks keyed alike). Front shall be attached to cabinets with hinged trim with piano-hinge down full length of one side to allow access to wiring without complete removal of outer trim. Front shall be provided with a metal directory and holder with clear plastic covering welded to the inside of the door. Fronts shall be code gauge full-finished steel with rust inhibiting primer and baked enamel finished in ASA #49 gray. Panelboards installed in exterior or wet locations shall have NEMA 3R enclosures.

E. Each section of multi-section panelboards shall be of matching heights and depths.

F. Panelboard enclosures shall be furnished as shown on panel schedule on plans for surface, flush or motor control center mounting.

2.4 MANUFACTURER

A. Panelboards shall be as manufactured by Square 'D', G.E., Siemens or Cutler Hammer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All panelboard dimensions and clearances shall be carefully checked and coordinated with the proper trades to insure proper mounting space and support prior to roughing in equipment. In no case shall any circuit breaker be located above 6’-7” A.F.F..

B. Wiring in panelboard gutters shall be done in a neat and workmanlike manner. Wiring shall be grouped into neat bundles and secured with approved tie wraps.

3.2 PANEL IDENTIFICATION

A. Refer to Specification Section 26 05 53.

END OF SECTION 26 24 16

SECTION 26 24 17

LIGHTING PANELBOARDS

PART 1 - GENERAL

1.1 GENERAL

A. The work under this section includes but is not limited to the following:
1. Lighting Panelboards
2. Circuit Breakers

PART 2 - PRODUCT

2.1 PANELBOARDS

A. Enclosure:
1. Panelboards shall be dead front type and shall be in accordance with Underwriter's Laboratories, Inc., standard of panelboards and enclosing cabinets and so labeled.
2. Panelboards installed in dry locations shall have enclosures fabricated from sheet steel and shall be finished in ASA #49. Panelboards installed in exterior or wet locations shall have NEMA 3R enclosures.
3. The door shall have a cylinder type lock. Lock shall be held in place by concealed screw to a captive nut, welded to inside of door. All locks shall be keyed alike.
4. A metal framed circuit directory card holder with clear plastic covering shall be factory-mounted on the inside of door.
5. Panels for 20 or more circuits, including spares and spaces, shall be 20 inches wide.
6. Panelboards enclosures shall be as shown on panel schedule on plans for surface, flush or motor control center mounting.
7. Provide hinged trim with piano-hinge down full length of one side to allow access to wiring without complete removal of outer trim.
8. Each section of multi-section panelboards shall be of matching heights and depths.

B. Bussing/Lugs:
1. Ampacity and service voltage of main buss, lugs or main breakers and branch circuit breakers shall be as shown on drawings.
2. All bussing and associated connectors shall be tin-plated aluminum or tin-plated copper.
3. All panelboards shall contain ground buss.
4. Entire panelboard shall be capable of withstanding a short circuit not less than the interrupting capacity of any breaker in the panel. When a power distribution system electrical study (including short circuit stud, etc.) is a part of the project, contractor shall further verify that all proposed equipment is properly rated (per the results of the study) prior to submitting shop drawings. Interrupting ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.
5. Buss connectors shall be for distributed phase arrangement.
6. Top/bottom feed arrangement and lug sizes/quantities shall be coordinated by the contractor.
7. Entire panelboard assembly, including all bussing, shall have SCCR ratings meeting or exceeding the minimum AIC ratings listed on the plans for the panel. When a power

distribution system electrical study (including short circuit stud, etc.) is a part of the project, contractor shall further verify that all proposed equipment is properly rated (per the results of the study) prior to submitting shop drawings. All ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.

8. Service entrance panelboards shall be provided with barrier such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations

C. Breaker arrangement and numbering:
   1. Panelboards shall be factory assembled with branch breakers arranged exactly as indicated on plans.
   2. Breakers shall be numbered vertically beginning top left. Multi-section panelboards shall be numbered consecutively through all sections.
   3. Breaker numbers shall be permanently attached to trim.
   4. Main breakers shall be vertically-mounted (branch-mounted or back-fed main breakers will not be acceptable unless specifically so shown on plans).

2.2 CIRCUIT BREAKERS

A. Circuit breakers shall be quick break, quick make, thermal magnetic type, for alternating current. Breakers shall trip free for the handle and tripping shall be indicated by the handle assuming a position between OFF and ON.

B. Circuit breakers shall be of the bolt-on type.

C. Multi-pole breakers shall be internal common trip with single operating handle; external handle ties are not acceptable, unless specifically noted otherwise (such as for multi-wire branch circuits described below).

D. Circuit breakers feeding multiwire branch circuits (as defined by NEC) consisting of separate single phase loads sharing a common neutral shall be provided with multi-pole breakers or handle ties to simultaneously disconnect all ungrounded conductors per NEC Article 210.4(B). The necessary locations of these multi-pole breakers or handle ties shall be coordinated by the contractor. Where necessary, the contractor may rearrange circuit breakers (as minimally as possible) as required to meet this requirement.

E. All breakers shall meet the minimum RMS symmetrical interrupting capacity ratings shown on plans for the associated panel. All interrupting ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.

F. All branch circuit breakers shall be listed to UL489 or shall be specially-tested to be HACR listed.

2.3 SPECIAL REQUIREMENTS

A. Any special requirements on the drawings, such as for increased interrupting rating, ground fault protection, etc., shall supersede these specifications, but only insofar as that particular requirement is concerned.

B. Lighting panels larger than 400A shall conform to the requirements for power panels.

2.4 MANUFACTURER

A. Panelboards shall be as manufactured by Square 'D', G.E., Siemens or Cutler Hammer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All panelboard dimensions and clearances shall be carefully checked and coordinated with the proper trades to insure proper mounting space and support prior to roughing in equipment. In no case shall any circuit breaker be located above 6’-7” A.F.F..

B. Wiring in panelboard wireways shall be done in a neat and workmanlike manner. Wiring shall be grouped into neat bundles and secured with approved tie wraps.

C. For all flush-mounted panelboards, a minimum of three (3) one-inch empty conduits shall be stubbed out above the nearest accessible ceiling space for future use.

3.2 PANEL IDENTIFICATION

A. Refer to Specification Section 26 05 53.

END OF SECTION 26 24 17

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Wiring Devices

B. Plates

C. Finishes

PART 2 - PRODUCTS

2.1 WIRING DEVICES AND PLATES

A. Switches shall be AC type, extra-heavy duty industrial grade (unless otherwise shown) of ratings shown on drawings. Switches shall be as manufactured by Hubbell, P & S, Sierra, Bryant, GE, Arrow Hart or equal.

B. Receptacles shall have blade configuration and shall be heavy duty industrial grade (unless otherwise shown) of current and voltage rating as shown on drawings. Receptacles shall be as manufactured by Hubbell, P & S, Sierra, Bryant, GE, Arrow Hart or equal.

C. All GFCI-type receptacles shall continuously self-test and shall trip/deny power if the receptacle does not provide proper GFCI protection or if the line/load terminations are miswired and shall provide visual indication of power status, trip conditions, ground fault conditions and end-of-life status.

D. Each wiring device shall have a plate (see “Finishes” section below for specific requirements).

2.2 FINISHES

A. All wiring devices (switches, receptacles, etc.) shall be colored to match the coverplates described below. For instance, all items covered by stainless steel, aluminum or malleable iron plates shall be gray in color.
   1. Exceptions:
      a. Emergency wiring devices shall be red.
      b. Isolated ground wiring devices shall be orange.

B. Coverplates for recessed, wall-mounted electrical items (switches, receptacles, telephone outlets, etc.) shall be stainless steel unless shown otherwise.

C. Coverplates, trim rings, etc. for recessed, floor-mounted electrical items (floor outlets, underfloor duct junctions, etc.) shall match finish of building hardware (302/304 stainless steel, brass, etc.) in area installed.

D. Coverplates for exposed electrical items (switches, receptacles, telephone outlets, etc.) shall be

of same material as exposed boxes (see Outlet Box Specification for required material type) and shall have beveled edges.

E. Coverplates for receptacles in wet locations shall be metallic, in-use type, rated for wet locations per NEC requirements unless noted otherwise.

F. See “Electrical Identification” specification section for coverplate labeling requirements.

PART 3 - EXECUTION

3.1 GENERAL MOUNTING

A. Symbols on drawings and mounting heights are approximate. The exact locations and mounting heights shall be determined on the job, and it shall be the Contractor's responsibility to coordinate with all trades to secure correct installation. For example, Contractor shall coordinate exact mounting heights over counters, in or above backsplashes, in block walls, and at other specific construction features.

B. Verify all door swings with Architectural. Locate boxes for light switches within four inches of door trim on swing side (not hinge side) of door.

C. Devices and associated plates shall not be used as support; outlet boxes shall be rigidly supported from structural members.

D. Mount all straight-blade receptacles vertically with ground pole up, unless specifically noted otherwise.

E. Unless otherwise shown or required by local handicap codes, outlet boxes shall be the following distances above the finished floor unless otherwise noted.
1. Receptacles and telephone outlets in offices and other finished areas: 1’-6” to the center of the box.
2. Receptacles and telephone outlets in equipment rooms and other unfinished areas: 4’-0” to the center of the box.
3. Receptacles over counters: As Noted
4. Switches, general: 4’-0” to the top of the box.
5. Fire Alarm Pull Stations: 4’-0” to the top of the box.
6. Fire Alarm Audio/Visual Devices: As shown on fire alarm shop drawings (Entire lens shall be above 80” and below 96” per NFPA 72).
7. Push-button, etc., general: 4’-0” to the top of the box.
8. Other device types: verify with engineer prior to rough-in.

END OF SECTION 26 27 26

SECTION 26 28 16

SAFETY SWITCHES AND FUSES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Safety Switches

B. Fuses

C. Branch Feeders

D. Feeders

PART 2 - PRODUCTS

2.1 SAFETY SWITCHES

A. Safety switches shall be quick-make, quick-break, NEMA heavy duty type HD, fused or nonfused as shown. Switch blades shall be fully visible in the off position.

B. Safety switches shall be furnished with transparent internal barrier kits to prevent accidental contact with live parts. Barriers shall provide finger-safe protection when the switch door is open and shall allow use of test probes and removal of fuses without removing barrier.

C. Fused switches shall have provisions for class R, rejection type fuses.

2.2 FUSES (600V)

A. Fuses for all branch switches shall be Bussman Mfg. Co., Dual Element, Class “R” Fusetron.

B. Fuses for main switch/switches shall be Bussman Mfg. Co. Hi-Cap.

2.3 MANUFACTURER

A. Safety switches shall be as manufactured by Square 'D', G.E., Siemens or Cutler Hammer.

B. Fuses shall be as manufactured by Bussman Mfg. Co. or equal.

PART 3 - EXECUTION

3.1 SAFETY SWITCHES

A. Safety switches shall be installed as shown on the plans and in accordance with N.E.C.

B. Locations shown for safety switches on plans are diagrammatical only. Exact locations shall be field coordinated by contractor as required to provide code-required clearances.

C. Switch enclosures shall be rated NEMA I indoors in dry locations and NEMA3R outdoors and

in wet areas.

D. Adequate support shall be provided for mounting safety switches. Safety switches shall not be mounted to the associated equipment (unless the safety switch is furnished with the equipment).

3.2 FUSES

A. Fuses shall be sized as shown on drawings, unless a smaller size is required by the associated equipment supplier, in which case the contractor shall provide fuses sized as directed by the associated equipment supplier at no additional cost.

B. Provide not less than one spare set of fuses for each size used. Provide an additional spare set for each five sets of same size fuses used.

END OF SECTION 26 28 16

SECTION 26 41 00

LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Furnish and install all materials and labor required to provide a complete and functional Lightning Protection and Common Grounding System as indicated, in strict accordance with this section of the Specifications and the applicable Contract Drawings.

1.2 STANDARDS & QUALITY ASSURANCE

A. The lightning protection system shall comply with all requirements of the latest edition of each of the following codes and standards. The latest edition of these codes and standards form a part of this specification:
1. U.L. Standard 96A.
2. Lightning Protection Institute - Installation Code LPI-175.
3. N.F.P.A. 780.

B. Equipment manufacturer shall be certified by the Lightning Protection Institute, and products approved for UL listing. All materials shall be manufactured by one of the following manufacturers:
1. Bonded Lightning Protection Systems
2. East Coast Lightning Protection
3. Erico/Eritech Lightning Protection
4. Harger Lightning Protection
5. Preferred Lightning Protection
6. Robbins Lightning
7. Thompson Lightning Protection

C. For approval of LPI manufacturer other than specified, complete proposed material data and installation drawings shall be submitted to Engineer for review not less than 10 days prior to bid date.

D. In order to insure integrity of installation, the system shall be installed under the direct jobsite supervision of a Certified Master Installer/Designer, who has qualified under the LPI's Certification Program as a Master Installer/Designer.

1.3 SUBMITTALS

A. Complete shop drawings of the entire lightning protection system showing the type, size, mounting details, and location of all equipment, grounds, cable routings, roof materials (for coordination of lightning protection system materials), etc., shall be submitted to the Architect-Engineer for approval prior to start of work.

B. Submittals shall document the local manufacturer’s representative’s Certified Master Installer/Designer qualifications from LPI.

PART 2 - PRODUCTS

2.1 SYSTEM

A. System materials in general shall be copper, copper alloy or aluminum with high-copper content bronze castings or aluminum castings (all compatible with associated surface materials and installed per UL, NFPA & LPI standards), and shall comply in weight, size and composition for the class of structure to be protected. The system shall consist of all necessary cables, air terminals, mounting bases, fittings, couplings, connectors, fasteners, surge protection devices, etc., as required to give a complete and coordinated system.

B. Copper conductors shall be utilized for all downleads and below-grade conductors.

C. Aluminum components shall be utilized in cases where copper is not compatible with mounting surfaces.

D. All ground rods shall be copper-clad steel.

E. All cable and all air terminals shall bear proper UL labels.

F. Air terminals shall have blunt tips.

G. System design shall be concealed wherever practical, with roof perimeter cables concealed in parapet walls, and mid-roof cables installed under roof slabs. Exposed cable on parapet walls will only be accepted if structural details preclude cable concealment. Cable drops for roof penetrations at downlead locations shall be made with solid-bar thru-roof connectors, with copper rod flashings. Bond rebars top and bottom at each downlead position and risers. Primary and secondary bonding of roof metals and equipment shall also be under roof slabs. Ground level, intermediate and roof level potential equalization shall be provided per current building Code classifications.

H. All system fittings except cable holders, regardless of Structure classification, shall be heavy-duty type made from bronze or aluminum castings and secured with bolted-pressure clamps. Pressure plates made from stamped or pressed metal parts, or fittings utilizing crimp-type pressure devices will not be allowed. All bolts, screws, and related type hardware shall be stainless steel.

I. Contractor shall coordinate with the roofing contractor to insure compatibility of any adhesive with the roofing system in use.

J. Cable fasteners shall be substantial in construction, electrolytically compatible with the conductor and mounting surface, and shall be spaced according to LPI, UL, and NFPA code requirements.

K. Where applicable, an approved bimetal transition fitting shall be used at the roof level to change from aluminum roof conductor to copper downlead cable.

L. Surge protection devices shall be provided on the power, telecommunications and other conductive electrical services at the points of entrance into the building(s) as required by UL96A in order to obtain the UL Master Label Certificate of Inspection. It shall be the responsibility of the electrical contractor to install or verify that a proper surge protection device has been installed on the each of the building electrical services to meet this requirement. This

may require surge protection devices in addition to those specifically shown on plans or called out within other specifications.

PART 3 - EXECUTION

3.1 SUPERVISION AND CERTIFICATION

A. The manufacturer's local representative shall be a Certified Master Installer/Designer under the LPI program, and shall provide direct jobsite technical supervision to Contractor's personnel during installation to insure compliance with all Code requirements. Upon job completion, Contractors shall furnish Owners with written certification on UL Master Label "C",that system is installed in compliance with above Standards.

END OF SECTION 26 41 00

SECTION 26 43 00

SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (<1000 V) power distribution and control equipment.

B. The specified unit(s) shall provide effective high energy transient voltage surge suppression, surge current diversion and high frequency noise attenuation in all electrical modes for equipment connected downstream from the facility's meter or load side of the main overcurrent device. The unit(s) shall be connected in parallel with the facility's wiring system.

C. The unit(s) shall be designed and manufactured in North America by a qualified manufacturer of suppression filter system equipment. The qualified manufacturer shall have been engaged in the commercial design and manufacturer of such products for minimum of ten (10) years.

D. All products that are submitted according to these specification will be required to meet this specification in it's entirety for both service and distribution TVSS systems. Any product that is submitted and does not comply with all parts of this specification will be subject to rejection.

1.3 DEFINITIONS

A. VPR: Voltage Protection Rating.

B. SPD: Surge Protective Device(s)

C. $I_{(n)}$: Nominal Discharge Current

1.4 SUBMITTALS

A. See specification section 26 05 00.

B. Product Data: For each type of product indicated. Include:
1. Maximum Single Impulse Surge Current Rating.
2. Surge Life (Repetitive Surge) Rating.
3. UL1449 (Latest Edition) Voltage Protection Ratings (VPR).
4. UL1449 (Latest Edition) Nominal Discharge Current (In).
5. Product dimensions and weights.
6. Furnished specialties and accessories.

C. Qualification Data:

D. Safety Agency File Number.

E. ISO 9001-2008 Certification.

F. ISO 1401-2001 Certification.

G. Operation and Maintenance Data: For SPDs to include all submittal data and any applicable operation and maintenance manuals.

H. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.

B. The unit shall be UL 1449 Listed and CUL Approved as a Surge Protective Device and UL 1283 Listed as an Electromagnetic Interference Filter

C. Provide 2nd party certified data demonstrating SPD response to ANSI/IEEE C62.41.2-2002 standard waveforms when tested according to IEEE C62.45.

D. Comply with NFPA 70.

E. All SPDs provided within this project at the service entrance, distribution panels, and sub-panels shall be from the same manufacturer.

1.6 PROJECT CONDITIONS

A. Service Conditions: Rate SPDs for continuous operation under the following conditions unless otherwise indicated:
1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
2. Operating Temperature: 30 to 150 deg F.
3. Humidity: 0 to 95 percent, non-condensing.
4. Altitude: Less than 13,000 feet above sea level.

1.7 COORDINATION

A. Where field-mounted SPD's are specifically shown on plans, coordinate locations of field-mounted SPDs to allow adequate clearances for maintenance.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.
1. Warranty Period: 10 years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective

covering for storage and identified with labels describing contents.

1. Replaceable Protection Modules: 1 of each size and type installed, where field-replaceable modular SPDs are provided.
2. Fuses: 1 of each size and type installed, where field-replaceable fuses are provided.

PART 2 - PRODUCTS

2.1 SURGE PROTECTIVE DEVICES

A. Manufacturer:

1. Integral Devices: Surge Protective Devices shall be as manufactured by the distribution equipment manufacturer (Square D, etc.), or by Surge Suppression Inc. if all of the performance of this specification are met and all UL listing of the equipment manufacturer are met.
2. External Devices (where specifically specified on plans): Surge Protective Devices shall be as manufactured by the distribution equipment manufacturer (Square D, etc.) or Surge Suppression Inc.

B. Each Surge Protective Device shall:

1. Be internal to the associated distribution equipment (without violating any applicable UL listings) unless specifically shown otherwise on plans.
2. Be UL 1449 (Latest Edition) listed.
3. Have short-circuit current rating complying with UL 1449 (Latest Edition), that matches or exceeds the short-circuit rating of the associated distribution equipment.
4. Be designed to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS voltage.
5. Have fuses, rated at 200-kA interrupting capacity.
6. Have a minimum UL 1449 Nominal Discharge Current (I_n) Rating of 20kA.
7. Be fabricated using bolted compression lugs.
8. Provide suppression for all ten (10) modes of protection.
9. Have LED indicator lights for power and protection status of each phase.
10. Have audible alarm, with silencing switch, to indicate when protection has failed.
11. Have form-C contacts rated at 2 A and 24-V ac minimum, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with facility monitoring and control system if monitoring by that system is required by plans or other specifications.
12. Have six-digit transient-event counter, mounted to front of equipment door, set to totalize transient surges (externally mounted SPD's may have the transient –event counter monted on the visible face of the SPD).
13. Meet all UL 96A requirements (for Lightning Protection Systems) where the device is installed at a service entrance of the facility. At a minimum, these devices shall:
    a. Be marked as Type 1 or Type 2 SPDs with product Identity consisting of "Surge Protective Device" or "SPD", and identifying all ratings so required by UL96A and the 4 digit alpha numeric Control Number.
    b. Have a minimum UL 1449 Nominal Discharge Current (I_n) Rating of 20kA.
    c. Be UL listed and labeled with holographic label.

C. Peak Single-Impulse Surge Current Rating shall be meet the following minimums unless

specifically shown otherwise on plans:

Application	Per Phase	Per Mode
Service Entrance Devices	240 kA	120 kA
Downstream Devices	160 kA	80 kA

D. The ANSI/UL 1449 voltage protection rating (VPR) in grounded wye circuits, the SPDs shall not exceed the following:

Modes	208Y/120V	480Y/277V	600Y/347V
L-N,L-G, N-G	800	1200	1500
L-L	1200	2000	2500

E. The ANSI /UL 1449 VPR for 240/120 V, 3-wire or 4-wire circuits with high leg shall not exceed the following:

Modes	240/120V
L-N,L-G, N-G	1200/800

2.2 ENCLOSURES

A. Where external units are specifically specified on plans, units not mounted within electrical distribution equipment (such as switchboards, MCC's, etc.) shall be provided in enclosures with NEMA enclosure ratings that match or exceed the NEMA enclosure ratings of the equipment from which the units are fed. For example, a unit fed from a NEMA 4X stainless steel panelboard shall also be mounted within a NEMA 4X stainless steel enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All SPD's shall be integrally-mounted within the associated distribution equipment unless specifically shown otherwise on plans.

B. Install SPDs at service entrance on load side, with ground lead bonded to service entrance ground.

C. Install SPDs downstream of the service entrance with conductors or buses between suppressor and points of attachment as short and straight as possible. The lead lengths between the TVSS unit and the equipment being protected shall not exceed fourteen (14) inches without approval from the engineer. Do not bond neutral and ground. Leads shall be as straight as possible with no sharp bends.

D. Where externally-mounted SPD's are specifically shown on plans, provide circuit breaker as

directed by the SPD supplier as a dedicated disconnecting means for SPD unless otherwise indicated.

3.2 FIELD QUALITY CONTROL

A. Ensure that interiors are free of foreign materials and dirt.

B. Check and test switches, pushbuttons, meters for proper operation.

C. Check and test indicating lights for proper operation and color.

D. Perform manufacturer's on site field test procedures.

3.3 STARTUP SERVICE

A. Do not perform insulation resistance (MEGGER) tests of the distribution wiring equipment with the SPDs installed. Disconnect all wires, including neutral, before conducting insulation resistance tests, and reconnect immediately after the testing is over.

3.4 SYSTEM WARRANTY

A. The SPD system manufacturer shall warranty the entire SPD system against defective materials and workmanship for a period of ten (10) years from the date of substantial completion. This warranty is in effect as long as the unit is installed in compliance with the manufacturer's installation, operation, and maintenance manual, UL Listing requirements, and any applicable national or local electrical codes.

B. Any SPD device which shows evidence of failure or incorrect operation, including damage as the result of lightning strikes, during the warranty period shall be replaced by the manufacturer at no charge to the owner. Warranty will provide for multiple exchanges of any inoperable devices at any time during the warranty period which starts at the date of substantial completion of the system to which the surge suppressor is installed.

C. The manufacturer is required to have a nationwide network of factory-authorized local service representatives for repair and service of this product. The manufacturer shall have a dedicated 1-800 telephone number for service problems and questions. This number shall be manned by a knowledgeable factory employee to ensure prompt response to any emergency situation that may arise.

END OF SECTION 26 43 00

SECTION 26 50 00

LIGHTING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Lighting Fixtures

B. Drivers

1.2 SUBMITTALS

A. Complete submittals shall be provided identifying all lighting fixture types and options, all lamp types (where applicable) and compliance with all contract requirements. The absence of clear submittal information specifically listing exceptions/deviations from detailed contract requirements will be understood to indicated that the contractor/supplier intends to meet all contract requirements. Refer to specification section 26 05 00 for additional requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Lighting fixtures shall be furnished as shown on plans and specified herein. It shall specifically be the responsibility of Contractor to verify exact types ceilings, walls, etc. and recessing depth of all recessed fixtures and furnish the specific mounting trims and accessories of the specified and/or accepted fixture specifically for the ceiling, wall etc. in which each fixture is to be installed.

B. Base bid manufacturers are listed on the lighting fixture schedule. Manufacturers listed without accompanying catalog numbers are responsible for meeting the quality standards, efficiency, maximum wattages and photometric distributions set by the specified product.

C. All lighting fixtures shall be so designed and shall have drivers and other similar items so installed as to function without interruptions or failures when operating in the environment in which they are proposed to be installed. Special attention shall be given to environments with potentially high ambient temperatures such as attic spaces, exterior soffits, confined interior soffits, coves, unconditioned spaces, etc. and shall be addressed by providing fixtures with suitable high ambient temperature ratings, remote mounting of drivers/ballasts, providing approved ventilation, etc. as directed by fixture manufacturer and approved by engineer, at contractor’s expense.

D. All fixtures installed such as to create penetrations through fire rated ceiling or wall assemblies shall be labeled as suitable for that purpose or installed with covers, tenting or other means as required to maintain the fire rating of the assembly.

2.2 LED LUMINAIRES

A. For the purpose of these specifications, LED Luminaires shall be defined as the entire LED fixture assembly including LED array, drivers, housing, electronics, etc. that compose the

lighting fixture.

B. Furnish and install LED Luminaire of proper size, type, efficacy, delivered lumen output, color temperature, distribution pattern, operational life, and CRI as shown on drawings.

C. LED Luminaires shall be tested in accordance with LM-79 and LM-80 standards.

D. LED drivers shall comply with NEMA 410 standards for inrush current, etc.

E. Exterior, pole mounted LED Luminaires shall be provided with an easily-serviceable, UL recognized surge protection device that meets a minimum 10kA Category C Low operation (IECC C62.41.2-2002). Device shall be wired in front of light engine(s) and driver(s) and shall fail "open" such as to prevent fixture operation after a surge protection failure.

F. LED Luminaires shall have a guarantee-warranty of at least five years unless specifically noted otherwise on contract documents.

G. LED Luminaire assembly shall comply with ambient temperature requirements specified in General section above.

2.3 STEMS/PENDANTS

A. Hangers shall be approved ball aligner type swivel, 30 degrees from vertical with swivel below canopy.

B. Stems/Pendants shall be rigid or IMC conduit unless specified otherwise on plans. Proposed stem/pendant types shall be submitted for review prior to shipment of light fixtures from factory.

C. Stems/Pendants shall be provided as required to prevent swaying of fixtures due to HVAC system airflow or other similar occurrences.

D. Shall be painted the same color as the fixture trim unless noted otherwise.

2.4 MANUFACTURER

A. Fixtures and stems shall be manufactured as shown in fixture schedule or approved equals.

B. Drivers shall be as manufactured by Philips/Advance, GE, Lutron, Magnatec, Motorola, EldoLED or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF LIGHTING FIXTURES

A. Support:
1. Support of all lighting fixtures shall be responsibility of electrical contractor. All lighting fixture supports shall be installed in accordance with lighting fixture supplier's recommendations.
2. Contractor shall coordinate installation requirements for all wall-mounted fixtures (especially for wall-mounted fixtures on uneven wall surfaces, etc.) as required to assure a

level/flat mounting surface and level/plumb/secure finished installation. Contractor shall provide flat mounting plates or other mounting provisions where necessary. Any proposed mounting plates, etc. shall be submitted to and approved by project architect prior to ordering materials.

3. Fixtures shall be supported independent of ceiling from structural members of building.
4. Lay-in fixtures shall be supported by four (4) taut 12 gauge hanger wires connected from each corner of the fixture to the structure above so that fixture is supported independent of the ceiling.
5. Other recessed light fixtures (including recessed downlights) shall be supported with two (2) taut 12 gauge hanger wires connected from opposing corners of the light fixture to the structure above so that fixture is supported independent of the ceiling.
6. Pendant mounted fixtures shall be directly supported from the structure above using a 9 gauge hanger wire or an approved alternate support without using the ceiling suspension system for direct support.
7. Tandem fixtures may utilize common hanger wires.
8. All lay-in fixtures shall be attached to ceiling grid by means of approved clips and in accordance with the N.E.C.
9. Contractor shall submit typical hanging detail to Engineer before installing any fixtures.

B. Connections:
1. All grid fixtures shall be wired by flex individually to junction and not wired fixture to fixture.
2. All flex shall contain 3 conductors (3rd wire ground). Ground wire shall be securely grounded at each end. Other conductors shall be connected by approved connectors.

C. Row-Mounted fixtures:
1. All stems on row-mounted fluorescent fixtures shall be installed as follows (except fixtures with slide grip hangers):
   a. One stem shall be installed in the first fixture knockout from end of row (on the first and last fixture of the row).
   b. One stem shall be installed between each two fixtures. Stem shall center joint where fixtures join and shall attach by use of “joining plates”.
2. All fixtures in continuous rows other than recessed grid type shall be connected by nipples with locknuts bushings.

D. Coordination:
1. Contractor shall coordinate all dimensions & locations of light fixtures prior to rough-in to insure proper fit and coordination with other trades.
2. Contractor shall verify exact ceiling types being installed and shall adjust fixture trim types accordingly (prior to submitting light fixture shop drawings).

END OF SECTION 26 50 00

SECTION 27 05 00

AUXILIARY SYSTEM CABLES, 0-50V

PART 1 - GENERAL

1.1 DESCRIPTION

A. Cables rated for 0V-50V application

PART 2 - PRODUCTS

2.1 GENERAL

A. Unless specified otherwise, all cables within the scope of this specification section shall:
1. Be rated for exposed cable tray installation.
2. Be plenum rated.
3. Be UL-rated for the proposed application.
4. Be multi-conductor with overall outer sheath as required by the application. The insulation of each conductor within the overall multi-conductor cable shall be uniquely color-coded. Ground conductors (when provided) within the multi-conductor cable shall have green insulation. Conductors with green insulation shall not be used for conductors other than ground.
5. Utilize copper conductors.
6. Have wire gauge as required to limit voltage drop to acceptable limits determined by the system supplier and to meet all applicable code requirements.
7. Where installed underground, within slab-on-grade or in exterior locations, be rated for wet locations.
8. Where required for specific systems, meet the specific requirements (conductor quantity, wire gauge, insulation type, shielding, etc.) of the system supplier.

2.2 CLASS 1 CONTROL CABLING (120VAC CONTROL CIRCUITS, ETC.)

A. In addition to above requirements, and unless specified otherwise, Class 1 control cabling shall:
1. Be rated for 600V.
2. Be industrial grade.
3. Have stranded conductors.
4. Have sunlight/oil-resistant PVC/Nylon insulation and jacket with ripcord.
5. Be manufactured by Belden, AlphaWire or General Cable.

2.3 CLASS 2 & 3 CONTROL CABLING (FED FROM CLASS 2 OR 3 POWER SUPPLIES)

A. In addition to above requirements, and unless specified otherwise, Class 2 & 3 control cabling shall:
1. Be rated for 300V.
2. Be shielded if so recommended by the system supplier/integrator.
3. Have twisted conductors.
4. Have plenum-rated insulation/jacket with ripcord.
5. Be manufactured by AlphaWire, Belden, General Cable, Superior Essex or West Penn.

2.4 NETWORK CABLING

A. Furnish and install all Ethernet, Fiber Optic and Backbone Copper Telephone cabling in accordance with all BICSI requirements and in accordance with other applicable specification sections.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Routing:
1. All wires and cables shall be installed in conduit unless specifically noted otherwise. Where conduit is not otherwise required by contract documents, 0-50V Cabling located within concealed, accessible ceiling spaces (such as above lay-in ceilings) may be run without conduit if the following requirements are met:
   a. Cabling is plenum-rated, multi-conductor.
   b. Cabling is supported by cable tray or with J-hook supports on intervals not to exceed 5'-0" on center. Cabling shall be supported solely from the cable tray or j-hooks supported from the building structure, without using piping, ductwork, conduit or other items as supports.
   c. Cabling is neatly formed, bundled and tied with plenum-rated Velcro straps on intervals not to exceed 30" on center.
   d. Properly-sized conduit(s) are provided wherever cabling enters an inaccessible or exposed area (such as above gyp board ceilings, within walls or through walls).
   e. Cabling is not a part of a Fire Alarm System, Smoke Control System, Emergency Generator Control System or other life-safety related system.
2. End bushings shall be provided on both ends of all raceway terminations.
3. No splices shall be pulled into conduit.
4. No cabling shall be pulled until conduit is cleaned of all foreign matter.

B. Penetrations:
1. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly.
2. For cabling not installed in conduit:
   a. Fire/smoke barrier penetrations shall be sealed utilizing an enclosed fire-rated pathway device (STI EZ Path or equal) containing a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed or retrofitted without the need to remove or reinstall firestop materials. The pathway shall be UL Classified and tested to the requirements of applicable ASTM/UL1479 standards.
3. For cabling installed within conduit from endpoint to endpoint:
   a. Fire/smoke barrier penetrations shall sealed utilizing fire caulk or other equivalent firestop systems around perimeters of conduits per UL requirements.
4. For cabling installed within cable trays:
   a. Fire/smoke barrier penetrations shall be sealed with one of the following methods:
      1) Continuous cable tray through the penetration, with a combination of large firestop pillows and small firestop pillows contained, supported and secured (to prevent unauthorized removal) on both sides by aluminum wire mesh and firestop putty. Firestop pillows shall be STI Series SSB or equal and Firestop putty shall be STI Spec Seal or equal.

2) Cable tray broken at the penetration, with fire/smoke barrier penetrations sealed utilizing an enclosed fire-rated pathway device (STI EZ Path or equal) containing a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed or retrofitted without the need to remove or reinstall firestop materials. The pathway shall be UL Classified and tested to the requirements of applicable ASTM/UL1479 standards.

C. Excess Cabling:
1. Excess cabling shall be neatly coiled within all junction boxes, pullboxes, wireways, etc. and at all terminations as required to allow future re-termination of cabling.

D. Terminations:
1. All conductors/cabling (including spare conductors) shall be properly terminated unless specifically directed otherwise. See below for general termination hardware requirements.
2. Cabling shall be neatly formed, bundled and tied at all terminations.

3.2 SPLICES/CONNECTIONS/TERMINATIONS:

A. Network Cabling:
1. Network and fiber optic cabling shall be continuous from endpoint to endpoint and shall not be spliced unless specifically noted otherwise.

B. Control Cabling:
1. Connections shall be made with T & B Sta-Kon wire joints EPT66M, complete with insulating caps. To be installed with WT161 Tool or C nest of WT11M Tool, Ideal Super - Nuts (not wire nuts), Ideal Wing Nuts, or Buchanan Elec. Products B Cap or Series 2000 Pressure connectors complete with nylon snap on insulators to be installed with C24 pressure tool.

C. Shielded cabling:
1. Unless directed otherwise by the system supplier, 0-50V cable shielding shall be grounded at the PLC/control panel end only (not at the field device end) with a termination kit as directed by the PLC/control panel supplier.
2. Shielded cabling shall be continuous from endpoint to endpoint and shall not be spliced without prior written approval from the Engineer.

3.3 LABELING

A. Refer to Specification Section 26 05 53 for all labeling requirements.

END OF SECTION 27 05 00

SECTION 27 10 00

STRUCTURED CABLING SYSTEM

PART 1 - GENERAL

1.1 SCOPE:

A. This document describes the products and execution requirements relating to furnishing and installing Telecommunications Cabling. Backbone and Horizontal cabling comprised of copper and fiber cabling, and support systems are covered under this document.

B. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the structured cabling contractor as detailed in this document.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types are indicated on the plans. If the bid documents are in conflict, this specification shall take precedence.

D. Refer to Specification Section 26 05 53 (Electrical Identification) for additional identification requirements.

E. Refer to Specification Section 27 05 00 (Auxiliary System Cables, 0-50V) for additional material and installation requirements.

1.2 REGULATORY REFERENCES:

A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the National Electrical Code, local ordinances and present manufacturing standards.

B. All materials shall be UL Listed and shall be marked as such. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

C. All modular jacks, patch cords, consolidation point, and patch cords shall be ETL Verified (not just tested) to be category 6 component and channel compliant.

D. The cabling system described in this specification is derived from the recommendations made in recognized telecommunications industry standards. The following documents are incorporated by reference:
1. ANSI/TIA/EIA - 568-B.1, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements, April, 2001
2. ANSI/TIA/EIA - 568-B.2, Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components, April, 2001

3. ANSI/TIA/EIA - 568-B.2-1, Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted Pair Cabling Components, Addendum 1 – Transmission Performance Specifications for 4-pair 100 Ω Category 6 Cabling
4. ANSI/TIA/EIA - 568-B.3, Commercial Building Telecommunications Cabling Standard Part 3: Optical Fiber Cabling Components, March, 2000
5. ANSI/TIA/EIA – 569-A, Commercial Building Standard for Telecommunications Pathways and Spaces, February, 1998
6. ANSI/TIA/EIA – 606-A, Administration Standard for Telecommunications Infrastructure of Commercial Buildings, February, 2002
7. ANSI/TIA/EIA – 607-AJ, Commercial Building Grounding and Bonding Requirements for Telecommunications, August 1994
8. ANSI/ TIA/EIA – 758, Customer-Owned Outside Plant Telecommunications Cabling Standard, April 1999
9. BICSI - TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM) 10TH edition.
10. National Fire Protection Agency (NFPA – 70), National Electrical Code (NEC) –2002
11. ANSI/TIA/EIA – 45-B, Test Procedures for Fiber Optic Connections.
12. ANSI/TIA/EIA – 526-14, Power Test for Fiber Runs.
13. FCC 47 CFR 68
14. NEMA 250
15. NEC Articles 770 and 800
16. ADA, Americans with Disabilities Act

E. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release.

F. This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project. All local State and federal codes are to be followed.

1.3 APPROVED CONTRACTOR:

A. The Structured Cabling Contractor must meet the following requirements:
1. Contractor must have a certified RCDD on staff. The project manager for this project shall have an RCDD certification, and RCDD shall be responsible for reviewing all aspects of the design, submittals and installation of all products.
2. All required submittal information shall be stamped by the RCDD.
3. Contractor must have a minimum of 3 years experience with projects of similar size and scope to this project.
4. The company performing the work must have been in business for a minimum of 3 years.
5. The company must have an office within 75 miles of the job site.

B. The Structured cabling contractor is responsible for workmanship and installation practices in accordance with the requirements of the standards described in these specifications and manufacturer's requirements.

1.4 WORK INCLUDED:

A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations necessary to complete the installation of this structured cabling system in compliance with the specifications and drawings. The structured cabling contractor will provide and install all of the required material to form a complete system whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:
1. Furnish and install a complete telecommunications wiring infrastructure.
2. Furnish, install, and terminate all UTP and Optical Fiber cable
3. Furnish and install all wall plates, jacks, patch panels, and patch cords at equipment racks and at work outlets (unless shown otherwise on plans).
4. Furnish and install all required cabinets and/or racks as required and as indicated.
5. Furnish any other material required to form a complete system.
6. Perform channel testing (100% of horizontal and/or backbone links/channels) and certification of all components.
7. Furnish test results of all cabling to the owner on disk and paper format, listed by each closet, then by workstation ID.
8. Provide owner test results and documentation. (Testing documentation and As-built drawings)

1.5 SUBMITTALS:

A. Within thirty (30) days of notice to proceed the structured cabling contractor shall submit the following items:
1. Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this spec.
2. Submit proof from manufacturer of contractor's good standing in manufacturer's certification program.
3. Submit copy of contractor's RCDD certification.
4. Submit listing of five (5) projects of similar size and scope to this project that have been completed within the last five years. Include in this submittal owner's contact information for each project.
5. Submit letter from the manufacturer stating that the manufacturer will provide a twenty-five year (25) warranty in accordance with the requirements paragraph 1.03 (B) of these specifications.
6. Submit appropriate cut sheets and samples for all products, hardware and cabling.
7. Submit 1/8" = 1'-0" drawings of floor plans indicating all work outlets and the labeling designation for each jack.
8. Submit ½" = 1'-0" drawings of each MDF and each IDF showing all racks, patch panels, 110 blocks, etc.

B. Work shall not proceed without the engineer's approval of the submitted items.

C. The structured cabling contractor shall receive approval from the engineer on all substitutions of material. No substituted materials shall be installed except by written approval from the engineer.

1.6 DRAWINGS:

A. It shall be understood that the electrical details and drawings provided with the specification package are diagrammatic. They are included to show the intent of the specifications and to aid the structured cabling contractor in bidding the job. The structured cabling contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications.

B. The structured cabling contractor shall verify all dimensions at the site and be responsible for their accuracy.

PART 2 - PRODUCTS

2.1 EQUIVALENT PRODUCTS:

A. Due to the nature and type of communications all products, including but not limited to faceplates, jacks, patch panels, racks, 110 blocks, and patch cords, for the purpose of this document, shall be manufactured by Hubbell, Ortronix, Panduit, Amp or Systimax. See below for acceptable cable manufacturers.

2.2 WORK AREA OUTLETS:

A. Work area cables shall each be terminated at their designated work area location in the connector types described in the subsections below. Included are modular telecommunication jacks. These connector assemblies shall snap into a faceplate.

B. The Telecommunications Outlet Assembly shall accommodate:
1. A minimum of two (2) modular jacks
2. Additional accommodations for specific locations as noted in the plans for optical fiber and/or additional copper cables as necessary
3. A blank filler will be installed when extra ports are not used.
4. A dust cap shall be provided on all modular jacks with the circuit number on the identifier strip.
5. Multiple jacks will be placed as documented on the plans.
6. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Prior to installation, the structured cabling contractor shall submit the proposed configuration for each outlet assembly for review by the architect.
7. The modular jack shall incorporate printed label strip on the dust cap module for identifying the outlet. Printed labels shall be permanent and compliant with ANSI/TIA/EIA-606-A standard specifications. Labels shall be printed using a printer such as a Brady hand held printer. Hand printed labels shall not be accepted.

C. Faceplates: The faceplates shall:
1. be UL listed and CSA certified.
2. be constructed of stainless steel (except where noted otherwise). All faceplate colors/materials in public areas shall be approved by the architect. In all cases the material and color of the faceplate shall match the adjacent electrical faceplate.
3. (where plastic faceplates are specifically allowed by the architect/engineer) shall match the faceplate color used for other utilities in the building or match the color of the raceway if installed in surface raceway.
4. be compliant with the above requirements along with the following when incorporating optical fiber:

a. be a low profile assembly,
b. incorporate a mechanism for storage of cable and fiber slack needed for termination,
c. position the fiber optic couplings to face downward or at a downward angle to prevent contamination and,
d. incorporate a shroud that protects the optical couplings from impact damage.

5. be available as single-gang or dual-gang.
6. possess recessed designation windows to facilitate labeling and identification.
7. shall include a clear plastic cover to protect labels in the designation window.
8. have mounting screws located under recessed designation windows.
9. comply with ANSI/TIA/EIA–606-A work area labeling standard.
10. allow for the UTP modules to be inverted in place for termination purposes.
11. be manufactured by an ISO 9001 registered company.

D. Voice / Data Jacks

1. Voice/Data jacks shall be 8-position modular jacks and shall be Category 6 performance as defined by the references in this document including ANSI/TIA/EIA-568-B.2-1. All pair combinations must be considered, with the worst-case measurement being the basis for compliance. Modular jack performance shall be third-party verified by a nationally recognized independent testing laboratory including, but not limited to, ETL.
2. The wiring scheme shall be T568A or T568B as directed by the owner.
3. The modular jack shall use dual reactance modular contact array.
4. The modular jack shall have low emission IDC contacts.
5. The modular jack shall use standard termination practice using 110 impact tool
6. The modular jack shall be backwards compatible to Category 3 and 5.
7. The modular jack shall be center tuned to category 6 test specifications.
8. Dust cover shall be used on each termination.

2.3 110 COPPER TERMINATION BLOCK:

A. The voice cross connect shall be a passive connection between the horizontal termination blocks and the backbone termination blocks. The wall mount frames shall be field terminated kits including all blocks, connecting blocks, and designation strips. Management rings shall be mounted between vertical columns of blocks to provide management of cross-connect wire. Backbone and horizontal blocks shall use 4-pair connecting blocks. Blocks shall be oriented so that backbone terminations are located on the left and horizontal frames are located on the right of the termination field when facing the frame assembly.

B. 110 Block Kits shall

1. include both the wiring block and connecting block in a 50, 100 and 300 pair footprint as required
2. be manufactured using fire retardant molded plastic.
3. include 4-pair 110C connecting blocks for field termination.
4. support termination of 22-24 AWG solid conductor
5. wiring blocks shall contain back openings for the feed through of cable
6. meet category 6 component compliance and be verified by a third-party nationally recognized independent testing laboratory
7. have color-coded tips on the wiring block and color coding on the connector blocks for installation identification.
8. shall use standard termination practice requiring a single conductor 110 impact tool

9. Termination hardware shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
10. be backwards compatible to category 3 and 5.
11. be labeled in compliance with ANSI/TIA/EIA-606-A labeling specifications using permanent labels and label printer.
12. be manufactured by an ISO 9001 registered company.

2.4 MODULAR PATCH PANELS:

A. The Modular Patch Panels shall
1. be modular design.
2. meet category 6 component compliance and be verified by a third-party nationally recognized independent testing laboratory
3. use low emission IDC contacts
4. use dual reactance technology to enhance the signal-to-noise ratio
5. require standard termination practices using a 110 impact tool
6. use a single piece IDC housing designed to accept larger Category 6 conductors
7. support both T568B and T568A wiring
8. include easy to follow wiring labels
9. include label fields
10. allow for the use of icons
11. include full length metal rear cable management
12. be available in standard or high density
13. be backward compatible to category 3 and 5.
14. be center tuned to category 6 test specifications
15. be sized to accommodate number of data or data and phone cables (where phone cables are terminated on patch panels in lieu of 110 blocks) served by each equipment room plus 30% spare capacity.
16. be separated by horizontal cable management sections.

2.5 RACKS:

A. The equipment rack shall provide vertical cable management and support for the patch cords at the front of the rack and wire management, support, and protection for the horizontal cables inside the legs of the rack.

B. Waterfall cable management shall be provided at the top of the rack for patch cords and for horizontal cables entering the rack channels for protection and to maintain proper bend radius and cable support. Double-sided wire management shall also be mounted above each patch panel and/or piece of equipment on the rack. The rack shall include mounting brackets for cable tray ladder rack to mount to the top of the rack. Velcro cable ties shall be provided inside the rack channels to support the horizontal cable. Rack shall be black in color to match the patch panels and cable management.

C. Free-Standing Racks shall:
1. have the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-B.
2. have top cable trough with waterfall and built in patch/horizontal cable distribution separator.

3. have horizontal front and rear cable management above, below and between each 48-port patch panel.
4. have a rack-mounted power strip.
5. have EIA hole pattern on front and rear.
6. be available with a 6.0" channel depth.
7. be available with hook and loop straps for securing bulk cables inside the vertical U-channels.
8. assemble as 19" (483 mm) or 23" (584 mm) with no additional hardware.
9. be available with three styles of vertical patch cord management: interbay with latches, cable management rings, or fingerduct with covers.
10. provide floor and ceiling access for cable management and distribution.
11. provide pre-drilled base for floor attachment of rack.
12. be available in standard color of black.
13. be manufactured by an ISO 9001 registered company.

D. Wall-Mounted Racks shall:
1. provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-B.
2. have top cable trough with waterfall and built in patch/horizontal cable distribution separator.
3. have horizontal front and rear cable management above, below and between each 48-port patch panel.
4. have a rack-mounted power strip.
5. have EIA hole pattern on front and rear.
6. be available with a 6.0" channel depth.
7. be available with hook and loop straps for securing bulk cables inside the vertical U-channels.
8. assemble as 19" (483 mm) or 23" (584 mm) with no additional hardware.
9. provide usable depth as required for standard network ethernet switch and other equipment
10. be available with three styles of vertical patch cord management: interbay with latches, cable management rings, or fingerduct with covers.
11. provide floor and ceiling access for cable management and distribution.
12. provide pre-drilled base for wall attachment of rack.
13. be available in standard color of black.
14. be manufactured by an ISO 9001 registered company.
15. be constructed to swing-out from wall (for rear access) via heavy-duty hinged corner and configurable for either left or right opening.

2.6 HORIZONTAL DISTRIBUTION CABLE:

A. Horizontal Distribution Cabling shall meet the following requirements:
1. Shall be 100 Ohm Enhanced Category 6 Unshielded Twisted Pair (UTP) Cable.
2. Physical Characteristics:
   a. Unless directed otherwise by owner (contractor shall verify with owner), Cat6 cable coloring shall be based on system type as follows, unless specifically approved otherwise:
      1) Data (or IP Voice): Blue
      2) Analog Voice: Grey
      3) Lighting Control System: White

4) Fire Alarm or other Life-Safety System: Red
5) CCTV Surveillance Cameras: Yellow
6) Other: As directed by owner

b. Shall be plenum-rated.
c. Shall meet applicable requirements of ANSI/ICEA S-80-576.
d. The diameter of the insulated conductor shall be .023 in. maximum.
e. Shall consist of (4) 22-26 AWG twisted pairs.
f. The overall diameter of the cable shall be no larger than 0.240 inches.
g. The ultimate breaking strength measured in accordance with ASTM D 4565 shall be 400 N minimum.
h. Cable shall withstand a bend radius of 1 inch at -20 degrees Celsius without jacket or insulation cracking.
i. Cable shall be third party verified to meet ANSI/TIA/EIA-568-B.2-1.
j. Where installed underground, within slab-on-grade or in exterior locations, be gel-filled and rated for wet locations.

3. Transmission Characteristics:
   a. DC resistance of any conductor shall not exceed 9.38 Ohms per 100m max. at 20° C. Measured in accordance with ASTM D 4566.
   b. The mutual capacitance of any pair at 1 kHz for 100m of cable shall not exceed 4.4 nF nominal.
   c. DC resistance unbalance any two conductors of any pair shall not exceed 5% when measured at or corrected to 20° C in accordance with ASTM D 4566.
   d. Structural return loss swept measurement for 100m or longer shall meet or exceed Category 6 requirements.
4. Shall be manufactured by Amp NetConnect, Berk-Tek, Leviton, General Cable, Mohawk or Superior Essex.

2.7 BACKBONE - FIBER:

A. Backbone Fiber Optic Cabling shall meet the following requirements:
   1. All optical fiber shall be Indoor/Outdoor,Tight-Buffered, All-Dielectric, Plenum rated (unless specified otherwise on plans) with Enhanced Multimode OM4-rated 50/125 Optical Fibers.
   2. Each Multimode Fiber shall:
      a. Be graded-index optical fiber wave-guide with nominal 50/125µm-core/cladding diameter.
      b. Comply with ANSI/EIA/TIA-492AAAC-A
      c. Have attenuation measured in accordance with ANSI/EIA/TIA-455-46, 53 or 61.
      d. Have information transmission capacity measured in accordance with ANSI/EIA/TIA-455-51 or 30.
      e. Have measurements performed at 23 degrees C +/- 5 degrees.
      f. Have Maximum attenuation dB/Km @ 850/1300 nm: 3.5/1.0
      g. Have bandwidth ≥ 4700 MHz-km @ 850nm. (EMB)
      h. Have bandwidth ≥ 500 MHz-km @ 1300nm.
      i. Be laser optimized and guarantee a 1 Gb/s distance of 1000 meters @ 850nm and 10 Gb/s at 600 meters @ 850nm.
      j. Terminate on fiber patch panel using SC Type fiber connectors.
   3. Each indoor/outdoor fiber optic cable shall:
      a. Be suitable for use in both outdoor and indoor applications without the use of a transition at the building entrance.
      b. Be suitable for use in risers, plenums and horizontal applications.

c. Have a dry water blocking system for cable.
d. Have a fiber strand count of 12 (unless shown otherwise on plans).
e. Have a nominal 2.21 mm sub-unit diameter.
f. Have and be marked with an UL-OFNP Flame Rating (unless engineer specified otherwise on plans).
g. Comply with Bellcore GR-409 and GR20
h. Be independently verified to comply with ICEA S-104-696
i. Have strength members of FGE/Aramid yarn.
j. Be suitable for underground or above ground conduits.
k. (Where applicable) Have Tight Buffered fibers color coded in accordance with EIA / TIA 598 with an overall black jacket.
l. Be suitable for operation between -40° to +70° C
m. Be UV resistant
n. Be of an all dielectric design

4. Shall be manufactured by Berk-Tek, Corning, General Cable or Superior Essex.

2.8 BACKBONE - COPPER:

A. Backbone Copper Cabling shall meet the following requirements:
1. Shall be Cat 3 rated.
2. Shall be RDUP PE-39 rated.
3. Where installed underground or in wet locations, shall include fully-flooded waterblocking compound to provide wet-location rating of cable.
4. Size of the backbone cables shall be determined by multiplying the number of horizontal voice cables to be terminated in each IDF by 200% and rounding up to the nearest 50 pair group. For Example if 94 horizontal voice cables are to be terminated in IDF1, install 94 x 1 pr x 200% = 188 pr rounded up to nearest 50 pr = 200 pr cable to IDF1.
5. Shall be manufactured by Berk-Tek, Corning, General Cable, Mohawk or Superior Essex.

2.9 COPPER CABLE SURGE PROTECTION DEVICES:

A. All copper circuits routed between or outside of buildings shall be provided with a surge protection device at each end. The surge protection device shall be labeled as meeting the requirements of the latest edition of UL 96A (exact requirements shall be coordinated with the lightning protection system supplier, where applicable).

B. The surge protection device shall be connected with a #6 AWG copper bonding conductor between the protector ground lug and the TC ground point.

2.10 PATCH CORDS:

A. The structured cabling contractor shall provide factory terminated and tested UTP and optical fiber patch cords and equipment cords for the complete cabling system. Patch cords shall be provided by the structured cabling contractor to connect patch panels to owner furnished electronics. The UTP patch cables shall meet the requirements of ANSI/TIA/EIA-568-B.2 and ANSI/TIA/EIA-568-B.2-1 for patch cord testing. Provide one set of optical fiber patch cables per fiber run that terminates on fiber patch panel and provide one category 6 patch cord for each category 6 work outlet that terminates on patch panel.

B. Copper (UTP) patch cords shall:
1. Be furnished to connect each patch panel jack to owner supplied electronics.

2. Be furnished for each work outlet jack.
3. Be a Category 6 patch cord manufactured by Panduit, Amp or Systimax.
4. Use 8 position connector with impedance matched contacts and designed using dual reactance.
5. Be constructed of 100 ohm, 4 pair, 24 AWG, stranded conductor, unshielded twisted pair copper per the requirements of the ANSI/TIA/EIA-568-B.2 and ANSI/TIA/EIA-568-B.2–1 standard.
6. Meet TIA category 6 component specifications in ANSI/TIA/EIA-568-B.2-1 100% factory tested to meet category 6 performance and ETL or any other nationally recognized 3rd party verification
7. Be capable of universal T568A or T568B wiring schemes.
8. Have modular connector that shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
9. Have a performance marking indelibly labeled on the jacket (by the manufacturer).
10. Have the ability to accept color-coded labels and icons to comply with ANSI/TIA/EIA-606-A labeling specifications.
11. Have "snagless" protection for the locking tab to prevent snagging and to protect locking tab in tight locations and provide bend relief
12. Be available in three standard colors
13. Be available in 3 foot, 5 foot, 7 foot, 10 foot, and 14 foot standard lengths
14. Be backwards compatible to Category 3, 5 and 5e

C. Fiber Optic patch cords shall:
1. Be furnished in the quantity of two (2) per IDF in each IDF and two (2) per IDF in each MDF.
2. Be manufactured by Panduit, Amp or Systimax.
3. Be multimode OM4 type.
4. Have connector type as directed by owner.
5. Have a performance marking indelibly labeled on the jacket (by the manufacturer).
6. Have the ability to accept color-coded labels and icons to comply with ANSI/TIA/EIA-606-A labeling specifications.
7. Be available in three standard colors
8. Be available in 3 foot, 5 foot, 7 foot, 10 foot, and 14 foot standard lengths

2.11 GROUNDING AND BONDING:

A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA/EIA-607 Telecommunications Bonding and Grounding Standard.

B. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a telecommunications ground bus bar (TGB). Each grounding bus shall be 12"W x 4"H x ¼"THK and be mounted to the backboard with porcelain isolators.

C. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of

green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

2.12 FIRESTOP:

A. A firestop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.

B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an UL listed firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.

2.13 INNERDUCT:

A. Innerduct, shall be:
1. Non-metallic, corrugated with pre-installed pull tape.
2. Plenum-rated, where installed within buildings.
3. UL listed for the application.
4. Size as required by the application.
5. Orange in color in concealed areas or within telecommunications or electrical rooms. Color shall be custom as selected by owner in exposed areas (such as within cable trays overhead in areas without ceilings outside telecommunications/electrical rooms).

PART 3 - EXECUTION

3.1 PRE-INSTALLATION SITE SURVEY:

A. Prior to start of work, meet at the project site with the owner's representative and representatives of trades performing related work to coordinate efforts. Review areas of potential interference and resolve conflicts before proceeding with the work. Facilitation with the General Contractor will be necessary to plan the crucial schedule completions of the equipment rooms and telecommunication closets.

B. Examine areas and conditions under which the system is to be installed. Do not proceed with work until satisfactory conditions have been achieved.

3.2 WORK AREA OUTLETS:

A. Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. No more than 12" of UTP and 36" of fiber slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B.1 document, manufacturer's recommendations and best industry

practices.

C. Pair untwist at the termination shall not exceed 12 mm (one-half inch).

D. Bend radius of the horizontal cable shall not be less than 4 times the outside diameter of the cable.

E. The cable jacket shall be maintained to within 25mm (one inch) of the termination point.

F. Data jacks, unless otherwise noted in drawings, shall be located in the bottom position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the right-most position(s).

G. Voice jacks shall occupy the top position(s) on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the left-most position(s).

3.3 HORIZONTAL DISTRIBUTION CABLE INSTALLATION:

A. All horizontal voice and data cabling shall be terminated on modular patch panels except for horizontal voice cables serving life safety related functions (fire alarm systems, security systems, elevator communications, etc.). All horizontal voice cabling serving life safety related functions shall be terminated on 110 blocks.

B. The voice and data cables shall be installed in separate patch panels.

C. All wiring above ceilings shall be installed in cable tray or open top cable hangers or in provided conduit.

D. Cable above accessible ceilings shall be supported 60” on center from cable support attached to building structure.

E. Do not untwist cable pairs more than 0.5 in. when terminating.

F. The Contractor shall be responsible for replacing all cables that do not pass Category 6 requirements for data and 5e for the voice applications.

G. Maximum horizontal cable length shall be 90 meters.

H. Cable shall have no physical defects such as cuts, tears or bulges in the outer jacket. Cables with defects shall be replaced.

I. Install cable in neat and workmanlike manner. Neatly bundle and tie all cable in closets. Leave sufficient cable for 90° sweeps at all vertical drops.

J. Do not install Category 6 cable with more than 110N (25 lbs) pull force, as specified in ANSI/TIA/EIA and BICSI TDDM practices. Utilize appropriate cable lubricant in sufficient quantity to reduce pulling friction to acceptable levels on long pulls inside conduit, pulls of multiple cables into a single small bore conduit, on conduit runs greater than 100 lineal feet with bends of opposing directions, and in conduit runs that exceed 180 degrees of accumulated bends. Use of tensile rated cords (i.e. fishing line) should be used for difficult or questionable

pulls - to judge to go/no-go condition of the conduit and pulling setup.

K. Cables jackets that are chaffed or burned exposing internal conductor insulation or have any bare copper (“shiners”) shall be replaced.

L. Test, label and document as called for in contract documents.

M. Firestop all openings where cable is installed through a fire barrier.

3.4 HORIZONTAL CROSS CONNECT INSTALLATION:

A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard, manufacturer's recommendations and best industry practices.

B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

D. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

E. The cable jacket shall be maintained as close as possible to the termination point.

F. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.5 OPTICAL FIBER TERMINATION HARDWARE:

A. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.

B. Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.

C. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.

D. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.

E. A maximum of 12 strands of fiber shall be spliced in each tray

F. All spare strands shall be installed into spare splice trays.

3.6 BACKBONE CABLE INSTALLATION:

A. Raceways:

1. All backbone cables shall be installed inside innerducts (see specification above) within conduits meeting specification requirements unless specifically noted otherwise.
2. Backbone cables shall be installed separately (in separate innerducts/conduits) from horizontal distribution cables.
3. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
4. Where backbone cables and distribution cables are specifically specified to be installed in a cable tray or wireway, backbone cables shall be installed first, within innerducts meeting specifications above, bundled separately from the horizontal distribution cables.

B. Support:
1. Within Telecommunications Rooms or at Telecommunications Backboards, all backbone cables shall be securely fastened to the backboards on the walls.
2. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
3. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
4. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

3.7 COPPER TERMINATION HARDWARE:

A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-A/B standard, manufacturer's recommendations and best industry practice.

B. Pair untwist at the termination shall not exceed 12 mm (one-half inch).

C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

D. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

E. The cable jacket shall be maintained to within 25 mm (one inch) of the termination point.

F. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.8 RACKS:

A. Floor-mount racks shall be used unless specifically shown otherwise.

B. Floor-mount racks shall be securely attached to the concrete floor using a minimum 3/8” hardware or as required by local codes.

C. Racks shall be placed with a minimum of 36 inches clearance from the walls on all sides of the rack. When mounted in a row, maintain a minimum of 36 inches from the wall behind and in front of the row of racks and from the wall at each end of the row.

D. All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 3.11 of this document.

E. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.

F. Wall mounted termination block fields shall be mounted on 4' x 8' x .75" void free plywood. The plywood shall be mounted vertically 12" above the finished floor. The plywood shall be painted with two coats of grey fire retardant paint.

G. Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame 18" from the finished floor.

H. Rack-mounted patch panels (and the associated horizontal cable management sections) furnished within the contract shall occupy no more than 40% of the available space within the associated racks (also furnished within the contract) unless specifically shown or specified otherwise. A minimum of 60% of available rack space shall be reserved for owner-furnished equipment. Where the number of patch panels and horizontal cable management sections would exceed 40% of the available rack space, an additional rack shall be installed.

3.9 EQUIPMENT TRAY FOR TELECOMMUNICATION ROOMS:

A. All equipment trays shall be 18" in width.

B. Furnish and install 18" equipment tray from each floor mount rack/server cabinet to wall. Furnish 18" equipment tray around wall as required to support cables. A minimum of two (2) walls shall be completely covered by equipment tray.

C. Furnish and install cable retaining posts on each side of tray every 4 feet as required to supports cables.

3.10 FIRESTOP SYSTEM:

A. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.11 GROUNDING SYSTEM:

A. The TMGB in the MDF shall be connected to the building electrical entrance grounding facility with a #6 AWG ground. Each TBB in each IDF shall be connected to a ground bus in the MDF with #4/0 AWG minimum ground. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

B. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the TR or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.

C. The TBB shall adhere to the recommendations of the ANSI/TIA/EIA-607 standard, and shall be installed in accordance with best industry practice.

D. Installation and termination of the main bonding conductor to the building service entrance ground shall be performed by the electrical contractor.

3.12 IDENTIFICATION AND LABELING:

A. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the successful structured cabling contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. Labeling shall follow the guidelines of ANSI/TIA/EIA-606-A.

B. All label printing will be machine generated by Panduit software (or other) using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.

3.13 TESTING AND ACCEPTANCE:

A. General
1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-B. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
2. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the Panduit Certification Program Information Manual and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

B. Copper Channel Testing
1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Horizontal cabling shall be tested using a Level III test unit for category 6 performance compliance, respectively.
2. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

3. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA/EIA-568-B.1 Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.
4. Category 6 Performance:
   a. Follow the Standards requirements established in:
      1) ANSI/TIA/EIA-568-B .1, B.2 and B.2-1
   b. A Level III test unit is required to verify category 6 performance.The basic tests required are:
      1) Wire Map
      2) Length
      3) Attenuation
      4) NEXT (Near end crosstalk)
      5) Return Loss
      6) ELFEXT Loss
      7) Propagation Delay
      8) Delay skew
      9) PSNEXT (Power sum near-end crosstalk loss)
      10) PSELFEXT (Power sum equal level far-end crosstalk loss)

C. Fiber Testing
1. All fiber testing shall be performed on all fibers in the completed end to end system. There shall be no splices unless clearly defined in an RFP. Testing shall consist of an end to end power meter test performed per EIA/TIA-455-53A. The system loss measurements shall be provided at 850 and/or 1300 nanometers for multimode fibers and 1310 and/or 1550 nanometers for single mode fibers. These tests also include continuity checking of each fiber.
2. Backbone multimode fiber cabling shall be tested at both 850 nm and 1300 nm (or 1310 and 1550 nm for singlemode) in both directions.
3. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B.
4. Where links are combined to complete a circuit between devices, the structured cabling contractor shall test each link from end to end to ensure the performance of the system. ONLY LINK TEST IS REQUIRED. The structured cabling contractor can optionally install patch cords to complete the circuit and then test the entire channel. The test method shall be the same used for the test described above. The values for calculating loss shall be those defined in the ANSI/TIA/EIA Standard.
5. Attenuation testing shall be performed with an approved hand held tester from an industry recognized test equipment manufacturer.

3.14 SYSTEM DOCUMENTATION:

A. Upon completion of the installation, the structured cabling contractor shall provide three (3) full documentation sets to the owners for approval. Documentation shall include the items detailed in the sub-sections below.

B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test result and

draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the Engineer, the structured cabling contractor shall provide copies of the original test results.

C. The Engineer may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the structured cabling contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

3.15 TEST RESULTS:

A. Test documentation shall be provided on disk within three weeks after the completion of the project. The disk shall be clearly marked on the outside front cover with the words “Project Test Documentation”, the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.

B. The field test equipment shall meet the requirements of ANSI/TIA/EIA-568-A/B including applicable TSB’s and amendments. The appropriate Level III tester shall be used to verify Category 6 cabling systems.

C. Test results generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. The structured cabling contractor must furnish this information in electronic form (CD-ROM).

D. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

3.16 AS-BUILT DRAWINGS:

A. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronic (DWG, AutoCAD rel. 2002) formats on which as-built construction information can be added. These documents will be modified accordingly by the structured cabling contractor to denote as-built information as defined above and returned to the Owner.

B. The Contractors shall annotate the base drawings and return a hard copy (same plot size as originals) and electronic (AutoCAD DWG) form.

3.17 WARRANTY:

A. The manufacturer shall provide a 25 year extended product warranty with a 25 year applications assurance warranty. Manufacturer shall provide the warranty directly to the end user.

B. An Extended Product Warranty shall be provided which warrants functionality of all components used in the system for 25 years from the date of registration. The Extended Product Warranty shall warrant the installed horizontal copper and the backbone optical fiber portions of the cabling system.

C. The Application Assurance Warranty shall cover the failure of the wiring system to support current or future applications that are designed for the link/channel specifications of ANSI/TIA/EIA–568-B.1. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, and 155 Mb/s ATM.

D. The contractor shall provide a warranty on the physical installation.

3.18 FINAL ACCEPTANCE & SYSTEM CERTIFICATION:

A. Completion of the installation, in-progress and final inspections, receipt of the test and as-built documentation, and successful performance of the cabling system for a two week period will constitute acceptance of the system. Upon successful completion of the installation and subsequent inspection, the end user shall be provided with a numbered certificate, from the manufacturer, registering the installation.

END OF SECTION 27 10 00

SECTION 27 41 00

TELEVISION DISTRIBUTION SYSTEM

PART 1 - GENERAL

A. The contractor shall provide and install a complete television distribution system as specified herein and as shown on the plans together with all accessories required to provide a complete operating system.

B. Equipment manufacturer name and model numbers specified are provided to establish quality of equipment and system operational features. Any proposed substitution of equipment from that specified must be approved by the Architect within ten (10) days prior to bid date.

C. The entire system shall be guaranteed for a period of one (1) year from the date of final acceptance of the installation and the Contractor shall repair or replace defective equipment, during this period, at no cost to the owner.

D. The system shall be designed to receive and distribute channels to all TV locations.

PART 2 - PRODUCTS

A. The line splitters shall be 2-way and 4-way as required and shall be Blonder Tongue SCVS series.

B. The directional couplers shall be Blonder Tongue SRT series as required.

C. The television distribution amplifier shall be Blonder Tongue BIDA550-50 and shall receive its input from Cable TV Company and other locations shown on the plans.

D. The receiver outlet shall consist of suitable connector mounted to wall plate. The receiver outlet shall be installed at all locations shown on the drawings.

E. All distribution cable shall be low-loss coaxial type, plenum-rated RG-6U (as manufactured by West Penn or Belden). See Specification Section 27 05 00 for additional requirements.

F. All head-end equipment shall be rack-mounted.

G. Provide filters, amplifiers, and any miscellaneous items required to rebroadcast the signal at the proper level for each channel.

H. All copper circuits routed between or outside of buildings shall be provided with a surge protection device at each end. The surge protection device shall be labeled as meeting the requirements of UL 96A (exact requirements shall be coordinated with the lightning protection system supplier, where applicable).

PART 3 - EXECUTION

A. Wiring shall be in strict accordance with the National Electrical Code and all state and local

regulations. Wiring shall be installed in accordance with manufacturer's wiring diagrams and shall test free from ground, opens and short circuits.

B. All connections shall be made under the direct supervision of a qualified technician.

C. All cables shall be terminated.

D. Wiring for the Television Distribution System is based on one manufacturer's recommendation. This contract requires that the installed wire be in accordance with the accepted manufacturer's recommendations.

E. Refer to Specification Section 27 05 00 for additional installation requirements.

F. Upon completion of job, the entire system shall be tested and a certificate shall be forwarded to the Architect be technician stating that he has personally verified the the following:
1. System is in accordance with specifications.
2. System is in correct operating condition.

END OF SECTION 27 41 00

SECTION 28 0723

SECURITY MANAGEMENT SYSTEM

PART 1 – GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. The General Conditions, Supplementary Conditions, and Division 01 P General Requirements apply.

1.2 SECTION INCLUDES

A. General description, functional requirements, operational characteristics, and criteria for the Security Management System (SMS).

1.3 RELATED SECTIONS

A. Division 26 - Electrical.

B. Division 8 - Door Hardware.

1.4 DEFINITIONS

A. API: Application Programming Interface.

B. LDAP: Lightweight Directory Access Protocol.

C. NTSC: National Television Standards Committee.

D. PAL: Phase Alternating Line. PAL is the color video standard used in Europe and many other countries.

E. SMS: Security Management System.

1.5 REFERENCE STANDARDS

A. Where more than one (1) reference standard, code, or regulation applies, the more stringent one shall govern.

B. Electronic Industries Alliance (EIA):
1. EIA RS-170 - Standard for Composite Video Signals.

C. Federal Communications Commission (FCC).
1. FCC Part 15 - Unlicensed RF Devices.
2. FCC Part 68 - Requirements for Connecting to the U.S. Phone Network.

D. Institute of Electrical and Electronics Engineers, Inc. (IEEE).

E. International Organization for Standardization (ISO).

F. International Radio Consultive Committee (CCIR).

G. Microsoft® Open Database Connectivity (ODBC) Interface.

H. National Fire Protection Association (NFPA):
1. NFPA 70 - National Electrical Code.

I. National Institute of Standards and Technology (NIST):
1. Federal Information Processing Standards Publication (FIP PUBS 197) - Specification for the Advanced Encryption Standard (AES).

J. National Television Standards Committee (NTSC):
1. Color Camera Broadcast Standard.

K. Underwriters Laboratories Inc. (UL):
1. UL 294 - Standard for Access Control System Units.
2. UL 1076 - Standard for Proprietary Burglar Alarm Units and Systems.

1.6 ACCESS CONTROL SYSTEM SHALL BE ONE OF THE FOLLOWING SYSTEMS

A. Honeywell Corporate ProWatch System vs 3.8.

B. Lenel OnGuard vs 6.4

C. Software House c Cure 9000 Enterprise

1.7 SECURITY MANAGEMENT SYSTEM (SMS) DESCRIPTION

A. The Security Management System (SMS) outlined in this section and detailed in Part 2 of this section is the key central component for managing physical security and the bridge between physical and logical security for a project. The system shall provide a variety of integral functions including: regulation of access and egress; provision of identification credentials; monitor, track and interface alarms.

B. The SMS shall utilize a single seamlessly integrated relational database for all functions utilizing a fully multi-tasking multi-threading Microsoft Windows 7 or 2008 or Vista or XP or 2003 Operating System. The SMS shall be written so that all system modules (access control, alarm monitoring, ID or credential management, visitor management, asset management and digital video management) are developed and built from a unified single 32-bit source code set. Separate source code bases for individual modules of the SMS are not acceptable.

C. Upgrades or expansion of the SMS to a larger size system in scale shall not require installation of a different and/or new SMS application or require the administrator or operator to learn a different and or new interface from the previous version.

D. The SMS shall be written using Unicode format. Unicode enables a single software product to be targeted across multiple platforms and languages without re-engineering and allows for data to be transported through different systems without corruption. Language Accessory Add-ons shall require a special language-specific license bit in order for the Language Pack to be used. E. The SMS software developer shall be a Microsoft Gold Certified Partner.

F. The SMS shall be Microsoft Windows XP Certified.

G. The SMS shall be compatible with Microsoft Windows 7, and shall have passed Microsoft-designed tests for compatibility and reliability on Windows 7.

H. The SMS shall be UL 1076 Listed (pending).

I. The SMS shall have FIPS 140-2 certification (pending).

J. The SMS shall only require a single license key to be present on the database server for the SMS to operate. The license key shall either be a physical device or a software license key. The SMS shall allow the SMS USER the ability to activate, return, or repair the software license key. The software license shall only be used on a physical computer or in a VMware virtual environment. License keys shall not be required at the client workstations. The license key on the database server shall determine the number of client workstations that shall be able to connect to the SMS as well as all SMS functionality. An alarm shall be generated in the SMS's Alarm Monitoring application as the license expiration date approaches.

K. The License Administration login and password shall be encrypted when they are passed to the License Server. The hash shall not be the same data even with the same logon credentials on different systems. This is a requirement for U.S. government DIACAP certification.

L. The SMS shall support concurrent licensing with respect to client licenses. CUSTOMER shall purchase a fixed number of client workstation licenses (or connections) that shall be programmed into the database server license file. The SMS shall be installed on any number of client workstations in the CUSTOMER facility. Then, any of the client workstations that have the SMS software installed shall have the ability to connect to the database server as long as the maximum number of concurrent connections purchased has not been reached. Connections shall be licensed on a per module basis. This shall provide CUSTOMER with great flexibility in system design and layout.

M. The SMS shall provide support for single sign-on capability. Single sign-on shall allow System Administrators/System Operators to authenticate into SMS applications using their Windows domain account.

N. Single sign-on shall support the following scenarios:

1. Allow System Administrators/System Operators to interactively run SMS applications without having to enter a username or password. This shall make administration of the SMS easier since maintenance of separate SMS usernames and passwords is not required.

2. Allow SMS API scripts to authenticate. These scripts shall be run using a Windows account allowing a seamless and secure way to authenticate the account and restricting the script to those actions that the user is permitted to perform.

O. The SMS shall be able to seamlessly interface with and monitor intelligent system controllers, reader interface modules, I/O panels, alarm panels, alarm panel receivers, biometric devices, personal protection devices, intercom systems, fire alarm panels (secondary monitoring only), building management systems and digital video recorders approved for use by the SMS manufacturer.

P. The SMS shall be able to communicate with intelligent system controllers via RS-485, RS-232, TCP/IP or Ethernet, and dialup via modem.

Q. Tasks shall be accessible from any compatible client workstation on the network utilizing one (1) or all of the following:

1. Traditional client-server architecture.
2. N-tier architecture where the SMS supports the expansion of the system architecture and allows for user deployment based upon their system architectural needs. The SMS shall allow for, but not require, the separation of the database, application server, Web server, and client interface. The system shall require that all connections to the database be performed through a trusted link from the client or internet browser interface.
3. Centralized distribution (publishing) of applications using Windows Terminal Server and Citrix® on Windows, UNIX, Linux or Apple Macintosh based systems through any compatible internet browser application and/or by means of a mobile computing platform using a wearable computer, Tablet PC, or PDA device.

R. Utilize an open architecture where all data must reside on a single database and must be accessible in real time to SMS workstation or Web-based client connected to the network. The system shall be configurable to support all of the following databases: Microsoft SQL Server 2008, Microsoft SQL Server 2005, Oracle Server 11g, and Oracle Server 10g. Oracle data may reside on Windows or UNIX platforms.

S. The system architecture shall support Microsoft Windows Clustering, Hot Standby, Fault Tolerant Servers and Fault Tolerant Hot Standby Servers.

T. The SMS shall be able to connect to and interface bi-directionally with external data sources utilizing all of the following methods:

1. ASCII with support for XML formatted text exchange of data activated both manually and automatically.
2. ASCII with support for XML formatted text exchange of data using a direct table interface activated both manually and automatically.
3. Real-time exchange of data via Active Directory or LDAP utilizing an API (Application Programming Interface) written by the SMS manufacturer. The live exchange of data shall expose SMS events and transactions to other data sources in real-time and allow for receipt of data into the SMS where this data may be acted upon and trigger linked events in the SMS in real-time.

U. All exterior cameras will be grouped in such a manner as to allow access by owner and Elmore County Sheriff's Department. All interior cameras will be grouped in such a manner as to allow access by owner only.

1.8 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Reference each product to a location on Drawings.

1. Manufacturer's technical data for all material and equipment at the system and sub system level to be provided as part of the SMS.

2. A system description including analysis and calculations used in sizing equipment required by the SMS. The description shall show how the equipment will operate as a system to meet the performance requirements of the SMS. The following information shall be supplied as a minimum:

a. Server(s) processor(s), disk space and memory size.
b. Description of site equipment and its configuration.
c. Network bandwidth, latency and reliability requirements.
d. Backup or archive system size and configuration.
e. Start up operations.
f. System expansion capability and method of implementation.
g. System power requirements and UPS sizing.
h. Device or component environmental requirements (cooling and or heating parameters).
i. A description of the operating system and application software.

B. Shop Drawings: Submit plans, elevations, sections, details, and attachments to other work.
1. Indicate all system device locations on architectural floor plans. No other system(s) shall be Included on these plans.
2. Include full schematic wiring information on these drawings for all devices. Wiring Information shall include cable type, conductor routings, quantities, and connection details at device.
3. Include a complete SMS one-line, block diagram.
4. Include a statement of the system sequence of operation.

C. Operation and Maintenance Data: For electronic security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23, include the following:
1. Provide Six (6) sets electronic format manuals including operating instructions, maintenance recommendations and parts list including wiring and connection diagrams modified to reflect as-built conditions.
2. Manuals: Deliver final copies of the manuals within thirty (30) days after completing the installation test. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the Contractor responsible for the installation and maintenance of the system and the factory representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation test shall include all modifications made during installation, checkout, and acceptance testing. The manuals shall consist of the following:

a. Functional Design Manual: Identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. Include a description of hardware and software functions, interfaces, and requirements.
b. Hardware Manual: Describe equipment furnished including:
    1) General description and specifications.
    2) Installation and check out procedures.
    3) Equipment layout and electrical schematics to the component level.
    4) System layout drawings and schematics.

5) Alignment and calibration procedures.
6) Manufacturer's repair parts list indicating sources of supply.

c. Software Manuals: Describe the functions of software and include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
1) Definition of terms and functions.
2) System use and application software.
3) Initialization, startup, and exit.
4) Reports generation.
5) Details on forms customization and field parameters.

3. As-Built Drawings: During system installation, the Contractor shall maintain a separate hard copy set of drawings, elementary diagrams, and wiring diagrams of the SMS to be used for record drawings. This set shall be accurately kept up to date by the Contractor with all changes and additions to the SMS. Copies of the final as-built drawings shall be provided to the end user in DXF format.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. SMS manufacturer shall be an established organization with referenced and documented experience delivering and maintaining SMS of equal or higher sophistication and complexity as compared to the system detailed in this specification.
2. SMS manufacturer shall employ at a minimum the following methods for quality assurance of component and assembly devices.
a. Perform visual inspection of devices to verify assembly according to defined procedures. Perform end of line operational tests to ensure product functionality has been correctly configured.
3. Perform individual functionality and system level regression testing to ensure compliance with product specifications. Perform single and multiple unit system tests to mimic end-user installation configurations. Utilize automated hardware and software testing to evaluate system performance under published operational loads and compare to published system capabilities.

B. Bidder Qualifications:

1. At the time of the bid, the bidder shall have satisfactorily completed projects of a similar size, scope and complexity as the system detailed in this specification. The bidder shall furnish written proof of experience from three (3) references and proof of current accreditation or certification by the manufacturer for required training for sales or installation or service of the SMS and associated devices.
2. Bidder shall be a Microsoft Certified Partner
3. The bidder shall also be a factory authorized local service organization that shall carry a complete stock of parts and provide maintenance for the SMS and related systems under this contract. Local shall be defined as an area in a 75 mile radius of installed location.

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging.

B. Store components and equipment in temperature and humidity controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 degrees Fahrenheit (10 and 29.4 degrees Celsius), and not more than 80 percent relative humidity, non-condensing.

C. Open each package; verify contents against packing list; and file copy of packing list, complete package identification, for inclusion in operation and maintenance data.

D. Mark packing list with the same designations assigned to materials, components, and equipment for recording in the system labeling schedules that are generated by software.

E. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.11 PROJECT CONDITIONS

A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
   1. Equipment and Components: Rated for continuous operation in ambient conditions of 60 to 85 degrees Fahrenheit (15.5 and 29.4 degrees Celsius) and a relative humidity of 20 to 80 percent, non-condensing.
   2. Indoor, Controlled Environment: NEMA 250, Type 1 enclosure. System components, except the central-station control unit, installed in [air-conditioned] [temperature- controlled] indoor environments shall be rated for continuous operation in ambient conditions dry bulb and 20 to 90 percent relative humidity, non-condensing.
   3. Indoor, Uncontrolled Environment: NEMA 250, [Type 3R] [Type 4] [Type 12] [Type 12K] enclosures. System components installed in [non-air-conditioned] [non-temperature-controlled] indoor environments shall be rated for continuous operation in ambient conditions dry bulb and 20 to 90 percent relative humidity, non-condensing.

1.12 WARRANTY

A. Guarantee equipment and labor and provide maintenance and services as follows: WARRANTY REQUIREMENTS FOR ALL SYSTEM COMPONENTS (LABOR and MATERIAL): 5 year (60 month) warranty on parts and labor for the access control system shall be included with bid.

B. This 60-month warranty shall include the following elements:

   1. 8-5, M-F Service, Service Provider must be same as bidder.
   2. Web Portal for creating service tickets and tracking service requests.
   3. Priority queue for service requests.

4. Electrical Surge Protection coverage.
5. Guaranteed Emergency Response - four (4) hours.
6. Guaranteed Non-Emergency Response - six (6) business hours.
7. Remote System Help Desk Support for Technical Support - 1 time per quarter.
8. Software License Technical support agreements and Installation of annual software updates 1 per year for 5 years.
9. On-Site System Review and Audit of System Functionality - 1 time per year.
10. Component Integrity Inspections - 2 times per year.
11. Replacement of Disposable Parts as needed (batteries, bulbs, connectors, etc.).
12. Training for office personnel on system functionality - 2 times per year.

1.13 SMS STARTUP AND COMMISSIONING

A. Entire security management system shall be commissioned by the manufacturer or manufacturer's representative.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: The security management system is based on products of Lenel Systems International, Inc., 1212 Pittsford-Victor Road, Pittsford, NY 14534; telephone: 585-248-9720, fax: 585-248-9185; Web site: www.lenel.com.

B. Honeywell Integrated Security, 135 West Forest Hill Avenue, Oak Creek, WI 53154; Phone: 414-766-1700, Fax: 414-766-1798; Web site: www.HoneywellIntegrated.com.

C. Software House, 6600 Congress Avenue, Boca Raton, FL 33487; Phone: 800 507 6268; Web site: www.swhouse.com.

2.2 ACCESS CONTROL CREDENTIAL READERS

A. Proximity Card Readers P Single-Gang Box Mounting (Thinline II)

1. Provide surface mounting style 125 KHz proximity card readers suitable for wall or US 2-S single-gang box mounting, and for mounting configurations as shown on the project plans.
2. The reader shall be capable of reading access control data in standard Wiegand formats up to 84 bits in length from any HID Proximity card or equivalent, outputting the data in one of the following configurations:
   a. The card reader shall output credential data in compliance with the SIA AC-01 Wiegand standard, compatible with all standard access control systems.
   b. The card reader shall output credential data using a Clock and Data interface, and be compatible with systems requiring a magnetic stripe reader.
3. The reader shall be capable of outputting a periodic reader supervision message at a configurable time interval, enabling the host system to signal an alarm condition based on the absence of this message.
4. The Proximity card reader shall provide the ability to change operational features in the field through the use of a factory-programmed command card. Command card operational programming options shall include:
   a. Reader beeps and flashes green on a card read, LED normally red, single line control of LED.

b. Reader flashes green on a card read, LED normally red, single line control of LED.
c. Reader beeps on a card read, LED normally red, single line control of LED.
d. Beeper and LED are controlled by host only, LED normally red, single line control of LED.
e. Reader beeps and flashes green on a card read, LED normally off, red and green LED's controlled individually.
f. Reader flashes green on a card read, LED normally off, red and green LED's controlled individually.
g. Reader beeps on a card read, LED normally off, red and green LED's controlled individually.
h. Beeper and LED are controlled by host only, LED normally off, red and green LED controlled individually
i. Change from Wiegand to Mag Stripe output format
j. Change from Mag Stripe to Wiegand output format
k. Reset to Factory Defaults

5. Proximity card readers shall provide the following programmable audio/visual indication:
a. A piezoelectric sounder shall provide an audible tone upon successful power up/self test, good card read, or whenever the beeper control line is asserted by the host.
b. A bi-color, red/green LED shall light upon successful power up/self test, good card read, or whenever the LED control line(s) are asserted by the host.
c. The reader shall have individual control lines for the sounder, and for red and green LED indication. When the LED control lines are asserted simultaneously, an amber LED indication will occur.
6. The reader shall have a configurable hold input, which when asserted shall either buffer a single card read or disable the reader, until the line is released. This input may be used for special applications or with loop detectors.
8. The reader shall require that a card, once read, must be removed from the RF field for one second before it will be read again, to prevent multiple reads from a single card presentation and anti-passback errors.
9. Typical proximity card read range shall be:
a. 5.5” (14cm) using HID Proxcard II card.
b. 2” (5.1 cm) using HID ProxKey II key fob
c. 3” (7.6 cm) using HID Microprox Tag
d. 1.5” (3.8 cm) using HID Prox/Wiegand Card
10. Proximity card readers shall meet the following physical specifications:
a. Dimensions: 4.70 x 3.0 x 0.68” (11.9 x 7.6 x 1.7 cm)
b. Weight: 3.3.oz (94 g)
c. Material: UL94 Polycarbonate
d. Two-part design with separate reader body and cover.
e. Color: Black, Gray, White or Beige as approved by the project architect.
11. Proximity card readers shall meet the following electrical specifications:
a. Operating voltage: 5P 16 VDC, reverse voltage protected. Linear power supply recommended.
b. Current requirements: (average/peak) 20/115mA @ 12 VDC 13. Proximity card readers shall meet the following certifications:

a. UL 294
b. Canada/UL 294
c. FCC Certification

14. Proximity card readers shall meet the following environmental specifications:
a. Operating temperature: -22 to 150 degrees F (-30 to 65 degrees C)
b. Operating humidity: 0% to 95% relative humidity non-condensing
c. Weatherized design suitable to withstand harsh environments The reader shall be of potted, polycarbonate material, sealed to a NEMA rating of 4X (IP55).

15. Warranty of Proximity card readers shall be lifetime against defects in materials and workmanship.

2.3 PROXIMITY CARDS

A. Furnish 150 proximity cards for owner's use.

2.4 PANIC BUTTONS

A. Panic buttons at clerical stations shall be United Security Products HUB-ES emergency switch mounted to casework.

B. Wall mounted panic buttons shall be a mushroom style push-button located at 48" AFF with plexiglass cover.

2.5 DOOR CONTACT SWITCHES

A. Door contact switches shall be GE Security 1072 recess mounted magnetic contacts. Coordinate exact location with door hardware supplier.

2.6 SERVER AND WORKSTATION REQUIREMENTS

A. Contractor shall furnish Cisco switches (exact model to be approved by DHR) for all Security Management System needs.

B. Database Servers
1. Servers for Windows 2008 or 2003 Access Control and Alarm Monitoring Systems
a. Dell PowerEdge R710
b. Intel® Xeon® E5520, 2.26Ghz, 8M Cache, Turbo, HT, 1066MHz
c. 4GB Memory (2x2GB), 1066MHz Dual Ranked UDIMMs for 1 Processor, Adv ECC
d. 24X IDE CD-RW/DVD ROM Drive
e. 160GB 7.2K RPM SATA 2.5" Hot Plug Hard Drive for Operating System
f. 160GB 7.2K RPM SATA 2.5" Hot Plug Hard Drive for Database
g. RD1000 Backup, Internal SATA Drive Bay for 2.5" Chassis
h. RD1000 Internal Removable Hard Disk for RD1000, 160GB Native / 320GB Comp
i. Four 10/100/1000 Ethernet Network Ports
j. 17 in. Flat LCD Monitor
k. Onboard VGA
l. 1 serial port
m. 6 USB 2.0 ports
n. Speakers

o. USB Keyboard
p. USB Optical Mouse
q. Surge Suppression Strip
r. Microsoft Windows Server 2008 or 2003 Operating System
s. Microsoft SQL Server 2008 or 2005 Relational Database Management System
t. SMS Server Software for Windows 2008 or 2003

2. Servers for Windows 2008 or 2003 PRO Access Control and Alarm Monitoring Systems
a. Dell PowerEdge R710
b. Intel® Xeon® E5520, 2.26Ghz, 8M Cache, Turbo, HT, 1066MHz Max Mem
c. 4GB Memory (2x2GB), 1066MHz Dual Ranked UDIMMs for 1 Processor, Adv ECC
d. 24X IDE CD-RW/DVD ROM Drive
e. 160GB 7.2K RPM SATA 2.5" Hot Plug Hard Drive for Operating System
f. 160GB 7.2K RPM SATA 2.5" Hot Plug Hard Drive for Database
g. RD1000 Backup, Internal SATA Drive Bay for 2.5" Chassis
h. RD1000 Internal Removable Hard Disk for RD1000, 160GB Native/320GB Comp
i. Four 10/100/1000 Ethernet Network Ports
j. Onboard VGA
k. 17 in. Flat LCD Monitor
l. 1 serial port
m. 6 USB 2.0 ports
n. Speakers
o. USB Keyboard
p. USB Optical Mouse
q. Surge Suppression Strip
r. Microsoft Windows Server 2008 or 2003

s. Microsoft SQL Server 2008 or 2005 Relational Database Management System
t. SMS Server Software for Windows 2008 or 2003

3. Servers for Windows 2008 or 2003 Credential Management Systems
a. Dell PowerEdge R710
b. Intel® Xeon® E5520, 2.26Ghz, 8M Cache, Turbo, HT, 1066MHz Max Mem
c. 4GB Memory (2x2GB), 1066MHz Dual Ranked UDIMMs for 1 Processor, Adv ECC
d. 24X IDE CD-RW/DVD ROM Drive
e. 160GB 7.2K RPM SATA 2.5" Hot Plug Hard Drive for Operating System
f. 160GB 7.2K RPM SATA 2.5" Hot Plug Hard Drive for Database
g. RD1000 Backup, Internal SATA Drive Bay for 2.5" Chassis
h. RD1000 Internal Removable Hard Disk for RD1000, 160GB Native/320GB Comp
i. Four 10/100/1000 Ethernet Network Ports
j. Onboard VGA
k. 17 in. Flat LCD Monitor
l. 1 serial port
m. 6 USB 2.0 ports
n. Speakers
o. USB Keyboard

p. USB Optical Mouse
q. Surge Suppression Strip
r. Microsoft Windows Server 2008 or 2003 Operating System
s. Microsoft SQL Server 2008 or 2005 Relational Database Management System
t. SMS Server Software for Windows 2008 or 2003 4. Servers for Windows 2008 or 2003 Integrated Systems
a. Dell PowerEdge R710
b. Intel® Xeon® E5520, 2.26Ghz, 8M Cache, Turbo, HT, 1066MHz Max Mem
c. 4GB Memory (2x2GB), 1066MHz Dual Ranked UDIMMs for 1 Processor, Adv ECC
d. 24X IDE CD-RW/DVD ROM Drive
e. 160GB 7.2K RPM SATA 2.5" Hot Plug Hard Drive for Operating System
f. 160GB 7.2K RPM SATA 2.5" Hot Plug Hard Drive for Database
g. RD1000 Backup, Internal SATA Drive Bay for 2.5" Chassis
h. RD1000 Internal Removable Hard Disk for RD1000, 160GB Native/320GB Comp
i. Four 10/100/1000 Ethernet Network Ports
j. Onboard VGA
k. 17 in. Flat LCD Monitor
l. 1 serial port
m. 6 USB 2.0 ports
n. Speakers
o. USB Keyboard
p. USB Optical Mouse
q. Surge Suppression Strip
r. Microsoft Windows Server 2008 or 2003 Operating System
s. Microsoft SQL Server 2008 or 2005 Relational Database Management System
t. SMS Server Software for Windows 2008 or 2003

B. Client Workstations PC Specifications

1. Client Workstations for Windows 2008 or 2003 SYSTEMS

a. Intel Pentium 4 Dual Core E2180, 2.0GHz, 1M L2 Cache, 800FSB
b. 1GB non-ECC, 667MHz DDR2 1x1GB (1DIMM)
c. 24X CD-RW/DVD Combo Drive
d. 80GB SATA II 3.0Gb/s, 8MB Cache, 7200 RPM hard drive
e. 10/100/1000 Ethernet Network Port
f. 1 serial port
g. 1 parallel port
h. 8 USB 2.0 ports
i. 17 in. Flat LCD Monitor
j. 64 MB Video Card
k. Speakers
l. USB Keyboard
m. USB Optical Mouse
n. Surge Suppression Strip
o. Microsoft Windows XP or Vista
p. Microsoft SQL Server 2008 or 2005 Client License

q. SMS Client Software for Windows XP or Vista
2. System Administration only
a. Dell OptiPlex 780 Small Form Factor
b. Intel® Pentium® Dual Core E5300 with VT (2.60GHz, 2M, 800MHz FSB)
c. 4GB DDR3 Non-ECC SDRAM, 1066MHz, (4 DIMM)
d. 8X Slimline DVD+/-RW
e. 160GB 7,200 RPM 3.5" SATA, 3.0Gb/s Hard Drive with NCQ and 8MB Cache
f. 10/100/1000 Ethernet Network Port
g. 1 serial port
h. 1 parallel port
i. 8 USB 2.0 ports
j. 19 in. Flat LCD Monitor
k. Integrated Video, Intel® GMA 4500
l. Internal Chassis Speakers
m. USB Keyboard
n. USB Optical Mouse
o. Surge Suppression Strip
p. Microsoft Windows 7
q. Microsoft SQL Server 2008 Client License
r. SMS Client Software for Windows 7
3. High Performance Video Viewing
a. Dell T3500 Precision Workstation
b. Intel® Quad Core Xeon® W3520 2.66GHz, 8M L3, 4.8GT/s, Turbo
c. 4GB, 1066MHz, DDR3 SDRAM, NECC (4 DIMMS)
d. 16X DVD+/-RW
e. 250GB SATA 3.0Gb/s with NCQ and 8MB DataBurst Cache
f. 10/100/1000 Ethernet Network Port
g. 1 serial port
h. 8 USB 2.0 ports
i. 19 in. Flat LCD Monitor
j. Dual 256MB NVIDIA® Quadro® NVS 295, 4MON, 4DP w/ 4DP to DVI Adapt k. Internal Chassis Speakers
l. USB Keyboard
m. USB Optical Mouse
n. Surge Suppression Strip
o. Microsoft Windows 7
p. Microsoft SQL Server 2008 Client License
q. SMS Client Software for Windows 7

2.7 COMPONENTS

A. SMS Software Capabilities: Support an unlimited number of card readers, input points, video cameras, intrusion detection points, and relay outputs. The SMS database server shall support an unlimited number of cardholders, visitors, and assets limited only by the available memory on the ISC. The database server shall also support an unlimited number of system events and

System Operator transactions in the history file limited only by available hard disk space. Client Workstations shall be limited only by the limitations of the operating system server software. The SMS functions are catergorizedinto nineteen primary “system modules” which shall include:

1. Access Control
    a. One of the SMS's primary purposes shall be to provide access control. The SMS shall be able to make access granted or denied decisions, define access levels, and set timezones and holidays. An input or output linkage feature shall allow linking of monitor zone points to output control points within Intelligent System Controllers (ISCs). The SMS shall support features such as area control (two man control, hard, soft, and timed anti-passback), database segmentation, and timezone or holiday overrides.
2. Alarm Monitoring
    a. The main Alarm Monitoring window shall provide information about the time and location of the alarm, along with its priority. The main Alarm Monitoring window must be able to sort pending and/or insert new alarms based on any of the following attributes: priority, date or time, alarm description, Intelligent System Controller, Card Reader, Input Control Module, asset name, or cardholder. Date or time sorts must be System Operator selectable to be either ascending or descending and must have the option of displaying the seconds of the minute in which the alarm arrived into the SMS. All columns of information in the main Alarm Monitoring window shall be able to be arranged in any order by the System Operator.
    b. The SMS must allow unique emergency instructions to be specified for each type of alarm. It shall also allow for the automatic sending of alphanumeric pages or e-mail messages upon alarm arrival. A real-time graphical system status tree on the screen shall indicate if card readers, alarm panels, digital video recorders, video cameras, intrusion detection panels, or Intelligent System Controllers are secured, unsecured, in alarm, or offline. Output control operations must be available to lock, unlock or pulse control points as a standard feature. An automatic cardholder call-up feature shall allow the quick search and display of images in the database. A System Operator journal shall be available to log important daily events. A trace function shall be available for System Operators to locate and track activity on specific cardholders, assets, video cameras, or card readers. An image comparison feature must be provided for use in conjunction with a CCTV interface. All alarms and hardware icons MUST have the ability to control the associated hardware via right-mouse clicks.

    c. The SMS must provide the option to be used as a UL 1981 Classified Central Station Automation System. This option must be classified by Underwriters Laboratories for use as a Commercial Burg Central Station Automation System, to allow the monitoring station where it is used to be made compliant with the UL 1981 standard and listed by UL. This classification shall apply to alarm panels monitored through a connected, UL approved Central Station Alarm Receiver.
3. Credential Management

a. The SMS shall include a seamlessly integrated credential management module. The credential management functionality must allow the enrollment of cardholders into the database, capturing of images, biometric data, and signatures, as well as the import or export of employee data. This functionality shall also allow the System Operator to assign and/or modify the access rights of a cardholder.
b. The SMS shall include a seamlessly integrated state-of-the-art, 32-bit, credential creation and production system. This shall allow for the creation of different badge types based on a database field, the linking of that field to a badge type to automate the process of credential production, and the use of security colors, chromakey, and ghosting, to allow officers to quickly identify personnel access authority.
c. The SMS shall have capabilities for biometric verification. Through the enrollment and comparison of hand geometry (the size of an individual's hand and fingers), or fingerprints, the identity of an individual shall be verified.
d. The SMS shall have the ability to crop and rotate an image automatically based on the orientation of the eyes found in the image. This shall include photographs captured from digital cameras, live cameras, scanned images and imported images.

4. Visitor Management
   a. The SMS shall include a visitor management module. The visitor management module shall be an application utilizing technology that allows a CUSTOMER to enroll and track visitors of the organization.
   b. The visitor management module shall allow a CUSTOMER to enroll visitors, sign them in or out, capture a photo, and capture a driver's license or passport. The visitor management module shall allow System Operators to enter and preschedule visits. The visitor management module shall allow System Operators to print visitor badges.
5. Remote Access Level Management
   a. The SMS shall include a seamlessly integrated remote access level management module.The remote access level module shall be a desktop-based application technology that allows CUSTOMER managers to assign and remove access levels to and from cardholders in the existing SMS database. All transactions relating to the adding and/or removal of access levels shall be recorded complete with a time and date stamp and the System Operator who made the change.
6. System Administration
   a. System Administrative tasks such as defining client workstation and System Operator permissions set-up, access groups, timezones, reports, maps, etc. shall be provided from any client workstation on the network. Initial setup of the cardholder screen layout shall occur on the database server. The SMS shall support the use of strong passwords.
7. Badge Layout Creation
   a. The SMS shall provide a Badge Layout Creation and Editing Module to allow for the creation of custom badge designs to be created by the CUSTOMER. The SMS shall support credit card, government, and custom credential sizes in

either a landscape or portrait format and shall support double sided and edge-toedge printing.

8. Screen or Forms Creation
    a. The SMS shall provide a Forms Designing and Editing Module that gives System Administrators the ability to modify any standard field to customize any or all of the cardholder, asset, or visitor forms. The SMS shall also allow System Administrators to add custom fields in addition to any standard fields on a minimum of 32 pages each of information for cardholder, visitor, and visit related data. User-defined fields absolutely shall not be pre-defined, meaning only the labels can change while the properties cannot. System Administrators shall have a minimum of 96 pages of which to design their cardholder, visitor, and visit screens with standard and custom fields.
9. Graphical Map Creation
    a. The SMS shall provide Graphical Map Creation and Editing Software that must allow System Administrators to import customized map backgrounds of their facility and to attach custom icons to those maps.
10. Application Programming Interfaces
    a. The SMS shall provide a set of standard Application Programming Interfaces (API's) and supporting documentation that allows hardware manufacturers and software application developers to integrate their products into the SMS. The Application Programming Interfaces shall allow requests from CUSTOMER to integrate a third- party hardware or software solution based on SMS open architecture and SMS device independence.
11. Data Import
    a. The SMS shall support an import utility that will allow the CUSTOMER or VAR to import cardholder information into the SMS database. This shall allow the CUSTOMER or VAR to pre-populate the SMS database with existing cardholder data and/or add new records to the existing SMS database.
12. Bi-Directional Data Exchange
    a. The SMS shall support a real time, bi-directional data interface to external databases such as Human Resources, Time and Attendance, Food Service Systems. The interface shall allow data to be imported into or exported out of the SMS in real-time or in a batch mode basis. Data used for import shall be retrieved directly from an external database or through an import file. Data provided for export shall be applied directly to an external database or through an export file. Any data shall be imported or exported including image data. The file used for import or created by export shall have the ability to be structured in a wide variety of ways, but shall always be in ASCII text format.
    b. The SMS shall also support a one step download and distribution process of cardholder and security information from the external database to the SMS database, all the way down to the Intelligent System Controller (ISC) database. This shall be a guaranteed process, even if the communication path between the SMS database server and the ISC is broken. If the communication path is broken, the data shall be stored in a temporary queue and shall be automatically downloaded once the communication path is restored.
13. API Development Toolkit

a. The SMS shall allow, through API toolkits, System Administrators to expose specific SMS data and events that are relevant to IT information or other thirdparty systems. Conversely, the SMS shall allow, through these same API toolkits, System Administrators to accept and process information exposed from the IT information or other third-party systems. This shall permit System Administrators to develop scripts and applications that allow events in either the IT domain to cause appropriate actions in the Security domain, and vice versa.

14. Server Redundancy
    a. The SMS shall support a fault tolerant server and redundant database architecture. The SMS shall also allow for a server clustering architecture. The SMS shall allow for normal operations to occur in the event that the Database Server fails. In the event of a server failure, the switch over to a backup server from a primary server shall be automatic and not impede the operation of the SMS.

B. SMS Software Functionality:
1. Timezones:
    a. The SMS shall be capable of creating and storing up to 255 timezones. Each timezone shall have a minimum of six (6) intervals. Each interval shall be assignable to any day of the week.
    b. Each timezone shall be assignable to an alphanumeric name of up to 64 characters. Timezones shall be applied to access levels, card reader modes, alarm inputs, alarm outputs, and alarm masking and logging functions. Timezones shall be allowed to belong to any or all access levels so that the timezone only has to be defined once.
2. Access Levels:
    a. Capable of defining a minimum of 32,000 access levels with a minimum of 128 access levels per cardholder per database segment. Access levels shall consist of a combination of card readers and timezones.
    b. Each access level shall be assignable to an alphanumeric name using up to 64 characters.
    c. Card readers shall have the ability to be assigned to any or all access levels defined in the SMS. Individual card readers shall be capable of having a distinct timezone assigned to it.
    d. Allow an ‘Allow User Commands’ option to be assigned on a per access level basis where keypad readers are in use.
    e. Allow a ‘First Card Unlock’ option to be assigned on a per access level basis.
3. Temporary Access Levels:
    a. Capable of assigning Temporary Access Levels inclusive of the 32,000 assignable Access Levels.
    b. Each Temporary Access Level shall be assignable to an alphanumeric name using up to 64 characters.
    c. Each Temporary Access Level shall be definable with a start and end date.

   d. Temporary Access Levels shall be stored in the ISC and functionality shall be maintained in the event of disconnection with the ISC.
4. Access Groups:
   a. The SMS shall be capable of assigning Access Groups with a maximum of 32 Access Levels per Access Group.
   b. Each Access Group shall be assignable to an alphanumeric name using up to 64 characters.
5. Precision Access Levels:
   a. The SMS shall be capable of assigning Precision Access Levels in addition to the 32,000 Access Levels with the ability to assign unlimited card reader and timezone combinations.
   b. Each Precision Access Level shall be assignable to an alphanumeric name using up to 64 characters.
6. Holidays:
   a. The SMS shall provide a minimum of 255 Holiday assignments using an embedded calendar. Holidays shall be assigned an alphanumeric name using up to 64 characters and shall be grouped into eight (8) types of holidays, and shall be assignable to individual timezones. Access rights, card reader modes, and alarm masking schedules must be able to be altered when the current date is designated a Holiday.
   b. Dates for Daylight Saving Time changes shall be definable and shall take effect automatically.
   c. The SMS shall support Holiday Ranges that allow a single holiday to span across multiple calendar days.
7. First Card Unlock: Feature that when configured retards a pre-determined timezone activated unlock command until a valid credential has been presented and granted access to the portal.
8. Database Segmentation: Support data segmentation whereby each segment shall have its own set of cardholders, field hardware and system parameters (timezones, access levels etc.). This segmentation shall expand the limitations of the SMS parameters (that is, access levels and timezones) to the maximum capacity of each parameter multiplied by the number of segments.
9. Field Hardware Communications:
   a. The SMS shall communicate with the ISCs by the following protocols: 1) RS-232
      2) RS-485
      3) TCP/IP
      4) Dialup via Modem
   b. Communication baud rate shall be system selectable with a range between 1,200 to 115,200 bits per second.
   c. Download communication between the SMS and the ISC shall be fully multi-tasking and shall not interfere with operational functions.
   d. Upon loss of communications between the SMS Server and the ISC an alarm shall be created with a time stamp. Upon re-established communication the SMS and the ISC shall automatically re-synchronize from the point of communication loss without operator intervention.
10. Multi-Drop Panel Support:

a. Support a multi-drop Intelligent System Controller architecture whereby up to eight (8) ISCs shall be multi-dropped on a single RS-485 communications line and whereby all eight panels communicate back to a single serial communications port.
b. The multi-drop panel support shall be used in conjunction with other ISC wiring support such as the star wiring configuration, home-run wire architecture, and advanced distributed network architecture.

11. Intelligent System Controller Remote Dialup Support:
    a. Support Remote Dialup operations to and from the Intelligent System Controller (ISC). The dialup connection shall be either a constant connection or a scheduled connection. If the connection is constant, then every panel shall have its own modem at the host. If the connection is scheduled, then all panels using remote dialup shall have the ability to share the same host modem(s).
    b. The LNL-2220 and LNL-3300 shall have native 10/100 Ethernet.
    c. System Administrators shall have the ability to define the modems available in the pool. For each modem, System Administrators shall be able to define the modem type and the client workstation that it is installed to.
    d. Dialup sessions shall occur under any of the user-defined scenarios:
        1) On Demand Connection: A System Operator shall have the ability to automatically initiate a dial in session to an ISC via the Alarm Monitoring application. 2) Scheduled Connection: System Administrators shall have the ability to configure the SMS so that the ISC dials into the SMS at a pre-determined times through use of timezones.
        3) Critical Alarm Activated: System Administrators shall have the ability to configure the SMS so that the ISC initiates a dialup session with the SMS when a critical alarm is activated in the field.
        4) Buffer Threshold: System Administrators shall have the ability to configure the SMS so that the ISC initiates a dialup session with the SMS when a pre-determined number of events are stored in the ISC memory buffer.
12. SMS to Intelligent System Controller Encryption
    a. Data security for encrypted connections between SMS and Intelligent System Controllers shall be provided by the full implementation of the Federal Information Processing Standard, FIPS-197, utilizing the 128-bit Advanced Encryption Standard (AES), also known as Rijandael, a symmetric encryption algorithm. The 128-bit AES encryption MUST be certified by the National Institute of Standards and Technology (NIST). FIPS-197 supersedes the aging Data Encryption Standard (DES) defined in FIPS-46-3. Implementation of FIPS-197 shall solve the data security requirements for open network connections by providing a means to secure the data over the non-secure network by encryption.
    b. The Intelligent System Controllers shall also support a 32-bit issue code. This shall only be used when implementing a Physical Access Control Systems (PACS) low and medium security profile enhancement.
13. Intelligent System Controller to Reader Interface and I/O Module Encryption
    a. Data security for encrypted connections between Intelligent System Controller and downstream modules (Reader interface and I/O Modules) shall be provided by utilizing the 128-bit Advanced Encryption Standard (AES), also known as Rijandael, a symmetric encryption algorithm.

b. The encryption between the ISC and downstream modules must support use of a diversified session key derived from a shared secret master key algorithm. The shared secret master key must be settable to insure uniqueness, and to authenticate connected modules prior to activating them for the session.

14. Area Control: Provide eight (8) area control features: Global Hard Anti-passback, Global Soft Anti-passback, Timed Anti-passback, Two Person Control, Designated One Person Control, Designated Two Person Control, Tail Gate Control, and Occupancy Limit. Area control shall be a security method of preventing a person from passing their badge to another person for dual entry into a single location utilizing one (1) card.
    a. The following summary criteria shall apply under Global Hard or Soft Anti-passback:
        1) Initially (Time 0) all cardholders are reset to Area 0.
        2) Any cardholder shall enter a controlled area any time after Time 0 by presenting a badge to a SMS entry card reader.
        3) A cardholder shall not exit the controlled area unless he or she has entered the area presenting a badge to the SMS entry card reader.
        4) A cardholder shall not enter the controlled area a second time unless the cardholder has exited that area previously.
        5) A cardholder shall be able to enter through any entry card reader and exit through any exit card reader of a single controlled area.
        6) These options shall include a “forgiveness” Administrator to reset the anti-passback of all cardholders to Time 0 Area 0, either through a manual override or a timezone command.
        7) The SMS shall provide an anti-passback exempt option for privileged or VIP (Very Important Person) cardholders. Cardholders with this option will not have anti-passback rules applied to them.
        8) The SMS shall also have a “forgiveness” feature that will allow the System Administrator to reset the anti-passback of an individual cardholder to Time 0 Area 0.
    b. Timed Anti-passback Feature: Permits the System Administrator to decide how long after a cardholder has swiped their badge that they will have to wait before the same badge will be accepted again at the same card reader. This helps prevent multiple swipes by an individual to allow access to others through turnstile doors.
    c. Two Person Control Feature: Provided to restrict access to certain areas unless there are two (2) cardholders present. This restricts individuals from being alone in restricted or highly secure areas. When an area is configured for Two Person Rule, the following criteria shall prevail:
        1) The card reader shall grant access only if two (2) valid cardholders (with authorized access levels) swipe their badges one after the other. In the event that a second authorized card is not presented within 10 seconds of the first authorized badge, the card reader shall reset and the first card will have to be swiped again. 2) Once two (2) people occupy an area, individual access shall be granted. 3) Individual exit shall be permitted until an area is occupied by only two (2) cardholders at which point the Two Person Rule applies for exit.
    d. Designated One Person Control: The SMS shall allow for a special One Person Mode. This mode shall require that a designated cardholder is present before anyone else is allowed to access a certain area. This restricts individuals from accessing a restricted or highly secure area when not accompanied by the designated cardholder. When an area

is configured for One Person Mode, the following criteria shall prevail: 1) The card reader shall grant access only if the designated cardholder (with authorized access level) swipes their badge.

2) Once the designated cardholder occupies an area, individual access shall be granted normally.

3) Individual exit shall be permitted until an area is occupied by only the designated cardholder, once the specific cardholder leaves, the area will again require the specific cardholder to be present before any other individual is allowed to gain access.

e. Designated Two Person Control: The SMS shall allow for a special Two Person Rule to restrict access to certain areas unless there are two (2) cardholders present and they are 78F<:A4G87 4 FC86<4? R-84@ &8@58ES 7<FG<A6G<BA. -;<F Eestricts individuals from being alone in restricted or highly secure areas as well as restricting the type of personnel allowed in a certain area. When an area is configured for the Designated Two Person Rule, the following criteria shall prevail:

1) The card reader shall grant access only if two valid cardholders (with authorized access levels and special Team Member distinction) swipe their badges one after the other. In the event that a second authorized card is not presented within 10 seconds of the first authorized badge, the card reader shall reset and the first card will have to be swiped again.

2) Once two (2) people occupy an area, individual access shall only be granted to other cardholders who have been designated the Team Member special distinction.

3) A Second designation, “Supervisor” can be assigned to other cardholders. Cardholders with the Supervisor designation shall be announced by means of a contact closure then their card is presented at the entry reader of the restricted area. The occupants of the restricted area may then choose to grant access to the supervisor by closing an external contact connected to the reader interface module, which will in turn energize the door strike output. Closing this contact at any other time shall not open the door.

4) Individual exits shall be permitted until an area is occupied by only two (2) cardholders with special Team Member distinction at which point the Designated Two Person Rule applies for exit.

g. Occupancy Limit Feature: Restricts the number of cardholders that shall be present in an area at any given time. The Occupancy Limit area shall be able to be defined by the System Administrator to limit up to 65,000 cardholders to be in that area at any given time. Once the occupancy limit has been reached, a cardholder must swipe out of the exit card reader before the next cardholder may enter. Each area for which Occupancy Limit is enabled shall be definable with up to 64 entry or exit card readers. Multiple Occupancy Limit Areas shall be definable.

15. Interlock group readers
16. The SMS shall have Interlock support. In the Anti-passback area, there shall be an option to make an area an interlock area. Interlocked areas shall be able to be configured, allowing only one door to be opened at a time within the area. This function shall only be able to be enabled for local anti-passback and shall be unavailable for global anti-passback.
17. The SMS shall support interlocking group readers. As soon as one door's strike is energized or door is open in the group, all other doors will be denied access until a condition is met.

When the SMS USER creates an area with the Interlock set, when one door strike of the area is active or if the door is open, then no door shall be allowed to open and there shall be an alarm.

18. There shall be an alarm for when access is denied due to interlock reader group. There shall be the alarm, "interlock Area Busy," that shall show up when trying to get access from a card. There shall be the alarm, "Exit Request Denied: Interlock Area Busy," that shall show up when pressing the REX button on the panel. There shall be the alarm, "Cannot Open Door: Interlock Area Busy," that shall show up when opening a door from the SMS's Alarm Monitoring application. All alarms shall have a priority of 100 in the SMS's System Administration application.
19. Field Hardware Configuration: All field hardware configuration windows shall be accessed from either the SMS Icon Toolbar or from menu options in the menu bar within the SMS configuration module of the software. When a field hardware device is configured, the device shall appear in the graphical system overview tree and in all appropriate forms.
    a. Configuration of Intelligent System Controllers (ISCs), Input Control Modules (ICMs), Output Control Modules (OCMs), and card readers shall be provided in a Windows format and shall include the following features:
    b. A tab format to logically group information into a series of forms within an icon or menu option. This shall allow for ease of configuration. For example, all forms that relate to the configuration of card readers shall be grouped together in the 'Card reader' icon.
    c. Drop-down lists to define features
    d. Check boxes
    e. Spin buttons
    f. Browse Buttons for ease of locating client workstations
    g. Sortable Lists
    h. Graphical System Overview Tree controls for ease of navigation and use
    i. The SMS shall have the ability for bulk add, modify, and delete privileges for ISCs and card readers to allow for the ease of addition and maintenance of these field hardware devices.
20. The SMS shall provide the ability to search large lists of devices for a string or substring in the device name.
21. Alarm Masking Groups: Support a group alarm masking feature whereas System Administrators shall be able to create groups of alarm inputs that enable them to mask or unmask multiple Input Control Module inputs and card reader inputs simultaneously. The following events shall have the ability to be part of an alarm masking group:
    a. Input Control Module Events
        1) Alarm Input Active
    b. Card Reader Events

1) Auxiliary Input Active
    2) Denied Count Exceeded
    3) Door Contact Tamper
    4) Door Forced Open
    5) Door Held Open
    6) Card Reader Input Tamper

c. Alarm Masking Groups shall be able to be masked as a group or as individual points.

d. Alarm Masking Groups must support the ability to be masked multiple times. Alarm Masking Groups shall be able to be masked and/or unmasked via alarm monitoring commands by guards, via card reader keypad function keys, or via global linkage commands.
e. The SMS shall support "Two Man Control" for masking Alarm Masking Groups.
f. The SMS shall support an Alarm Masking Group status change (Masked to Unmasked or Unmasked to Masked) action to be linked to a function list that is capable of performing many system actions, such as activating a relay output. The SMS shall support a minimum of 64 Alarm Masking Groups per Intelligent System Controller with a minimum of 200 alarm inputs per Alarm Masking Group.

22. Global Input or Output or Event Linkage:
    a. Support a global linkage feature whereby any input or output or event shall be linked to any other input or output or event in the SMS. Input or Output Linkages shall be able to span across Intelligent System Controllers.
    b. System Administrators shall be able to create global I/O function lists, each consisting of a sequence of actions to be performed, such as changing card reader modes, activating outputs, and opening or closing anti-passback areas. Each function list may include up to six (6) actions.
23. Cardholder Use Limits: Support a Cardholder Use Limit feature that shall allow System Administrators to specify the maximum number of times that a cardholder may use their credential at card readers in the SMS.
24. Extended Individual Door Held Open Times: The SMS shall support Extended Individual Door Held Open Times that allows a card reader's door to be held open for an extended period of time beyond the pre-determined standard held open time on a per cardholder basis. The extended held open time shall be user-definable up to 131,070 seconds. Extended held open times shall be set on a card reader by card reader basis.
25. Extended, on Demand, Door Held Open Times:
    a. Support extended, on demand, door held times via a command keypad. The Extended Held Open command configuration shall consist of a command key sequence that shall be from 3 to 6 keys used to enter the number of minutes to extend the door held open time (up to 999 minutes) and a pre alarm time (from 0 to 30 minutes).
    b. Only those cardholders having Command Authority at a given card reader configured for 'Allow User Commands' shall have the ability to execute the Extended Held Open command at that card reader. The Extended Held Open command shall be available after a valid cardholder has received an Access Grant at the card reader. The cardholder shall have a period of fifteen seconds after the Access Grant to enter the extended held open command sequence.

26. Graphical System Overview Tree: Displays a graphical representation of all field hardware (including ISCs, fire panels, intrusion detection devices, personal safety devices, intercom systems, and central station alarm receivers), digital video hardware, access levels, timezones, access groups, holidays, and card formats that have been configured in the SMS. System Administrators shall be able to modify a device that is depicted on the graphical system overview tree or see its properties by double-clicking on the icon and the SMS shall bring them to the appropriate form.

27. Pre-Alarm: The SMS shall support a pre-alarm feature at the card reader. The pre-alarm will sound a tone at the card reader prior to the door held open alarm. The pre-alarm setting shall be configurable for up to a maximum of 131,070 seconds (2,184.5 minutes or 36.4 hours).
28. Alarm or Event Logging:
    a. All alarms and events in the SMS shall by default, always be recorded in the database. The SMS shall give System Administrators the ability to select on a timezone basis, the times that they require the SMS to log specific events to the database.
    b. System Administrators shall have the option for Alarm or Events to be set to log or not to log particular alarms or events on any individual reader and or input.
29. Scheduling Utility:
    a. An integral Scheduling Utility shall be provided. The Scheduling Utility shall allow System Administrators to schedule actions to occur on a one-time or a recurring basis. Recurring schedules shall be configured to begin immediately, last indefinitely, or have optional start and end dates.
    b. The Scheduling Utility shall be available from both the System Administration and Alarm Monitoring applications.
    c. The types of actions that shall be schedulable include but are not limited to:
        1) Action Group
        2) Event Archiving or Purging
        3) Arm or Disarm Area
        4) Start of Guard Tour
        5) Execution of Data Exchange Scripts
        6) Activate, Deactivate, Pulse Device Output and Device Output Groups
        7) Global Anti-Passback Reset
        8) Download Firmware to ISCs and IP Cameras
        9) Download Firmware to Lenel Network Video Recorders (LNVR)
        10) Download Database to ISCs
        11) Execute Function List
        12) Mask or Unmask Inputs, Input Groups, Alarm Mask Groups, Door Forced Open or Held Open
        13) Open Door, Open Door Group
        14) Change Reader Mode
        15) Automatic Reports
        16) Reset Use Limit
        17) Move Bulk Badges from an Area
        18) Deactivate Badges
        19) Logout Visitors
        20) Schedule PTZ Presets
    d. The Scheduling Utility shall maintain a history log in the database for actions that it executes.
30. Multiple Card Formats: Support an unlimited number of card formats. Magnetic stripe and Wiegand card formats shall be supported. Each ISC shall support a minimum of eight (8) access control card formats and if applicable, eight (8) asset formats. As such, each card reader shall also be able to support a minimum of eight (8) access control card formats. If applicable, asset readers shall be able to support a minimum of eight (8) access control card formats and eight (8) asset management card formats. The SMS shall support any magnetic

stripe format that uses card number, facility code, and issue code combinations with a maximum of a nine digit card number and two digit issue code. The SMS shall support any industry standard Wiegand card format.

31. Card Reader Cipher Mode: Support a card reader Cipher Mode that shall allow authorized cardholders to enter their Badge ID by typing it into a card reader keypad, thus emulating the presentation of the credential to the card reader.
32. Denied Access Attempts Counter: Support a denied access attempts count on a per card reader basis. The "Denied Attempts Count" value shall be configurable from 0 to 255. The following access denial types shall cause the current denied count to be incremented: a. Unknown PIN entry at a card reader configures as 'PIN or Card' mode
    b. Invalid cipher entry at a card reader in Cipher Mode
    c. Invalid PIN entered for a given card at a card reader configured 'Card and PIN' mode
    d. Non-matching biometric presented for a given card at a card reader in biometric verify mode.
33. Card Reader Timezone Overrides:
    a. Allow for the pre-defined default card reader settings to be overridden or temporarily changed on a timezone basis. At the beginning of a selected timezone, the selected card reader's operational mode shall be modified from its default mode to any one of the following modes: locked, unlocked, facility code, card only, card or PIN, card and PIN, card and Biometric, card or PIN and biometric, and/or card and PIN and biometric. The aforementioned options shall be available depending on the type of card reader utilized.
    b. Each card reader shall have the ability to have multiple timezone setting overrides assigned to them as required by the System Administrator.
34. Online Context-Sensitive Help: Provide online context-sensitive help files to guide System Administrators and System Operators in the configuration and operation of the SMS. The help menu shall be available from any window in the SMS by pressing the F1 function key or clicking on the Help icon in the toolbar. Help windows shall be context-sensitive so System Administrators can move from form to form without leaving the help window. The SMS shall also come with complete online documentation on the product disc.
35. Monitor Zones:
    a. The SMS shall provide System Administrators the ability to segment their access control SMS field hardware devices into various zones or areas where alarm monitoring client workstations will monitor. These zones shall be assigned an alphanumeric name using up to 128 characters.
    b. The SMS shall allow subset relationship devices (such as card readers or ICMs to Intelligent System Controllers) to be automatically part of the monitoring zone when an ISC is selected AND it shall allow the System Administrator to define which subset devices (card readers, ICMs, etc.) belong to that monitor zone.
    c. Updating of monitor zones shall take place in real time and without requiring operators to re-login.
36. Advanced Field Device Control: The SMS shall allow a System Operator to monitor all alarms in their assigned monitor zone, but only be capable of performing field device control actions on specified devices in the assigned monitor zone. The SMS shall allow System Administrators to set permission control for individual devices within a monitoring zone for command override. The list of permissions for control under the monitor permission groups shall include the following: a. Access modes

b. Open doors
c. Relay and reader outputs
d. Set panel clock
e. Mask alarms and inputs
f. Unmask alarms and inputs
g. Mask alarm mask groups
h. Unmask alarm mask groups

i. Execute function lists
j. Paging
k. E-mail
l. Panel dialup
m. Standalone test mode
n. Download firmware
o. Arm areas
p. Disarm areas
q. Silence area alarms

37. Alarm or Event Routing:
    a. The SMS shall be capable of allowing System Administrators to route alarms and events to various alarm monitoring client workstations on the network. The SMS shall allow any alarm or event to be routed to one or multiple client workstations on the network regardless of where the alarm is generated in the field. Alarms shall be routed to client workstations on a device by device level.
    b. The SMS shall be capable of automatic re-routing of an alarm from workstation X to workstation Y if the alarm is not responded to within a user-definable time period.
    c. The SMS shall implement network synchronization that in the event alarm or event is routed to multiple client workstations, once the first client workstation 'grabs' the alarm, the alarm or event shall be cleared from all other client workstations. As such, alarms that are routed to an alarm monitoring client workstation which does not have a System Operator logged in shall be queued so that all unacknowledged alarms will report to that client workstation once a System Operator has logged into the SMS. Alarms or Events shall be routed based on default settings or timezone control.
38. Text Instructions: Allow for a set of text instructions to be associated with each alarm that arrives into the SMS. The text instruction function shall allow the System Administrator to enter a minimum of 32,000 characters of text for procedures to follow for each alarm that arrives at the alarm monitoring client workstations. Each alarm or event in the SMS shall have its own unique set of text instructions should the System Administrator desire. 39. Alarm Attributes: The System Administrator shall have the ability to configure how the SMS handles the annunciation of alarms on an individual basis. Each alarm and/or event shall have the option(s) to:
    a. Display at one or more alarm monitoring client workstation.
    b. Allow higher priority alarms to be displayed on the alarm monitoring client workstation ahead of lower priority alarms.
    c. Require the field device, which generated the alarm to be restored to its normal state before the alarm is cleared.
    d. Print the alarm to the local event printer.
    e. Have a customized voice message annunciate at the client workstation.

f. Have the alarm breakthrough to the alarm monitoring window should the System Operator be working in another application.
g. Allow System Operators to change the journal entry once the alarm has been acknowledged.
h. Insure that the alarm will not be able to be deleted from the alarm monitoring window upon acknowledgment.
i. Display text and audio instructions outlining the procedures to follow when responding to the alarm.
j. Automatically call-up associated maps.
k. Automatically call up the associated cardholder record.
l. Automatically call up the associated cardholder photo using the video verification function.
m. Require a password to view the alarm.
n. Require a password to acknowledge the alarm.
o. Require acknowledgment to clear.
p. Allow mandatory journal entry upon acknowledgment.
q. Use pre-defined journal entries for alarms.
r. Select the option for journal entry based upon the specific alarm.
s. Automatically send an e-mail message.
t. Automatically send an alphanumeric page.
u. Have the alarm appear on the alarm monitoring window with a flashing colored coded bar across the alarm for high priority alarms.
v. Have the alarm, when acknowledged, display an alternative flashing color coded bar across the alarm than for the original alarm color.
w. Trigger a function list(s) when the alarm is acknowledged. x. Require User Logon for Acknowledgment

40. Alarm-Event Mappings: The SMS attributes in Alarm Attributes shall be assignable on a 'global' basis to all devices that share an alarm description. Thus, the 'door force open' alarm attributes shall apply to any door with a card reader that is forced opened in the SMS. The SMS shall have the capability to assign a unique group of alarm attributes to specific device or alarm combinations to override the global settings for specific case settings. For example, System Administrators may assign a different set of attributes to be applied to a 'door force open' at a bank vault or research facility than they would if the front door was forced open. The SMS must include this type of flexibility. Each device or alarm combination shall have the ability to have its own unique attribute set if the System Administrator desires.
41. System Downloads:

a. The SMS shall provide for the downloading of data to the ISCs. Downloads shall load SMS information (timezones, access levels, alarm configurations, etc.) into the ISCs first, followed by cardholder information and card reader configurations.
b. All ISCs on the SMS shall be capable of either full or selective downloads to individual Intelligent System Controllers and bi-directionally so that alarms will still report to their respective alarm monitoring client workstations as cardholder information is being downloaded.
c. A complete database download of 10,000 cardholder records to all ISCs (regardless of the number of ISCs) must be complete within ten (10) minutes.

d. Information on cardholder status, badge status, timezones or access levels shall download in real time as they are added, modified, or deleted from the SMS.

42. Card Reader Options: Include the following options for each reader on the system:

a. Allow User Commands
b. Rename Auxiliary Inputs
c. Rename Auxiliary Outputs
d. Independently Supervise REX and DPS
e. Configure REX and DPS as Normally Open or Normally Closed
f. Deny if Duress
g. Assume Door Used h. Alarm Masking
i. Activate Outputs
j. Two Card Control
k. Checkpoint
l. Do Not Activate Strike on REX
m. The ability to allow System Administrators to determine on a timezone basis to log or not to log on a card reader by card reader basis:
    1) Access Grants
    2) Access Denied
    3) Card Reader Status Alarms.
n. Allow for user-definable door strike functionality for each card reader in the SMS.
o. Allow for each card readed to be selected as either an ‘in’ reader, ‘out’ reader, or ‘none’ to allow for ease of reporting time and attendance basic ‘time in’ and ‘time out’ data.
p. Enforce Use Limit: This option shall enable Card Use Limits at the card reader limiting the number of times that cardholders may use their credential to gain access at the card reader.
q. Alarm Shunt: The SMS shall have the ability to shunt a door contact of separate intrusion detection systems. When the SMS provides an access granted a dedicated auxiliary output shall first trigger and bypass the door contact of the separate intrusion detection system, and then the door locking mechanism shall unlock. Once the door returns to a secure state the door contact of the separate intrusion detection system shall return to its normal state.
r. Supervise Door: Sets the SMS so that the card reader door contact is wired as a supervised input.
s. Relaxed door forced open detection: The SMS shall provide an option that when selected shall allow for the door to be opened for an additional three (3) seconds time period after the request-to-exit sensor has been returned to the normal state.
t. Allow for one (1) or more access points in a specified area to be armed and disarmed directly from the Command Control Keypad.

43. Input Control Module (ICM) Options: Provide the following options for the Input Control Modules:

a. Alarm Masking: The ability to mask the alarm input on a timezone basis.
b. Local Linkage: The ability to locally link outputs with inputs that are attached to the same ICM or Output Control Module (OCM).
c. Activate Output: The ability to activate an output tied to the ICM or OCM on a timezone basis.
d. Activate Output Always: The ability to activate an output always.

e. Configuration of Debounce Times: The ability to control the amount of time that an input state change must remain consistent in order for it to be considered a real change of state.
f. Configuration of Hold Times: When configuring an Alarm Input, a hold time setting shall be settable from 0-15 seconds.
g. Checkpoint: The ability to configure an input as a designated stop on one or more guard tours.
h. Supervised Input: The ability to specify if a specific alarm contact on the ICM is a supervised or unsupervised contact.

44. Entry or Exit Delay: The ability to set up entry or exit delays for inputs that are attached to any ICM, SRI, or DRI. System Administrators shall have three options for entry or exit delay:

a. Non-Latched Entry: When an input activates, the alarm will not be reported until the Entry delay expires. If the input is still active when the entry delay expires, the alarm will be reported. If the input is not active when the entry delay expires, then the alarm will not report.
b. Latched Entry: When an input activates, the alarm will not be reported until the Entry delay expires. If the input is still active when the entry delay expires AND the alarm has NOT BEEN MASKED, the alarm will be reported. If the input has been masked when the entry delay expires, then the alarm will not report.
c. Exit Delay: When an input activates, the alarm will not be reported (operates as if masked) until the Exit delay expires. If the input is still active when the exit delay expires, the alarm will be reported. If the input is not active when the exit delay expires, the alarm will not be reported.

45. Intelligent System Controller Options: System Administrators shall have the ability to group add, modify, and delete Intelligent System Controllers (ISCs) in the SMS. The SMS shall have a copy command, allowing System Administrators to easily and efficiently add ISCs. The copy command will copy all information configured for an ISC selected and apply those same characteristics to the new ISC being added. System Administrators shall apply those same characteristics to the new ISC being added. System Administrators shall also have the ability mark ISCs as ‘online’ or ‘offline’ depending on whether those panels are online. The SMS shall also prompt the System Administrator if the System Administrator attempts to configure the number of cardholders (and assets, if applicable) that will be downloaded to an ISC to a number greater than that which the ISC’s memory can handle.
46. Strike Follower
47. An output for a reader can be overridden so that it is configured to activate and deactivate timed with a door strike. It can be set for a delay time and/or pulse.
48. There shall be a mode called "Strike Follower". The mode shall be optional and mutually exclusive with alarm shunt and tailgate. Strike Follower shall override the auxiliary 1 output and shall allow the output to follow the strike pulse. It shall be configurable with a delay and a pulse time.
49. The settings shall include:

a. Activation delay
b. Mode: Pulse or Follower
c. Pulse time: When pulse is used, a pulse time can be specified.

50. Alarm Monitoring - Alarms Monitored: When the SMS is configured, the System Administrator shall assign a default monitor zone to be monitored. The monitor zone shall include default alarm types with default timezones of which the alarm type will be monitored. These monitor zones will then be assigned to an alarm monitoring client workstation. The SMS shall allow for the monitoring of a combination of one or more ISCs, ICMs, alarm inputs, alarm outputs, and card readers. If applicable, the SMS shall also allow the monitoring of a combination of digital video recorders, video cameras, fire alarm panels, intrusion detection devices, central station alarm receivers, intercom exchanges, intercom stations, and personal safety panels. System Administrators shall have the option to define monitor zones to include all sub devices of an ISC and/or digital video recorders or to choose which sub devices of an ISC and/or digital video recorder belong to that monitor zone. Alarm monitoring client workstations shall be configured to annunciate any or all of the following types of alarms: access granted alarms, access denied alarms, system alarms, emergency alarms, and/or area control alarms.
51. The SMS shall allow for automatic update of the list of hardware devices as they are added, modified or deleted from the SMS. Newly configured devices and changes to existing devices shall be reflected in the hardware list automatically. The SMS shall indicate a deleted device by changing the icon and text associated with the device. Upon the next login, the SMS shall remove the device from the hardware tree.
52. Alarm Annunciation Configuration: The System Administrator shall have the capability to configure how the SMS handles the annunciation of alarms on an individual alarm or event basis. Each alarm and/or event shall have the option(s) to: a. Display on the alarm monitoring client workstation.
    b. Allow higher priority alarms to be displayed on the alarm monitoring client workstation ahead of lower priority alarms.
    c. Require the field device that generated the alarm to be restored to its normal state before the alarm shall be cleared from the alarm monitoring window.
    d. Print the alarm to the local event printer.
    e. Have a customized voice message annunciate at the client workstation.
    f. Have the alarm breakthrough to the alarm monitoring window should the System Operator be working on another application on the alarm monitoring client workstation.
    g. Allow System Operators to change the journal entry once the alarm has been acknowledged.
    h. Require that the alarm not be deleted from the alarm monitoring window upon acknowledgment.
    i. Display text and audio instructions outlining the procedures to follow when responding to the alarm.
    j. Automatically call-up associated maps upon arrival.
    k. Automatically call up the associated cardholder record with photo when the alarm displays.
    l. Automatically call up the associated cardholder photo in the video verification function when the alarm displays for comparison to a live video image at the card reader.
    m. Automatically call up live video from a digital CCTV camera to view the area in alarm
    n. Allow the System Operator to control digital CCTV camera functions including pan, tilt, zoom, focus, and iris controls.
    o. Require System Operators to enter in a password to view the alarm.
    p. Require System Operators to enter in a password to acknowledge the alarm.

q. Require System Operator acknowledgment to clear.
r. Allow mandatory journal entry upon acknowledgment.
s. Have pre-defined "canned" journal entries for alarms in the SMS.
t. Allow non-essential events to be cleared without requiring System Operator journal entry, while other alarms shall require System Operator journal entry.
u. Automatically send an e-mail message to one or more e-mail recipients.
v. Automatically send an alphanumeric page to one or more pagers.
w. Have the alarm appear on the alarm monitoring window with a flashing colored bar across it for high priority alarms based on its priority. Each priority in the SMS shall have its own unique color assigned to it. A minimum of 255 colors must be available for assignment to a minimum of 255 priority levels.
x. Have the alarm, when acknowledged, display a different flashing colored bar across the alarm than for the original alarm color. Each acknowledged priority in the SMS shall have its own unique color assigned to it. A minimum of 255 colors must be available for assignment to a minimum of 255 priority levels.
y. Insert and display alarms based on sort order. System Operators can sort on alarms based on alarm priority, time, date, alarm description, card reader, alarm input device, ISC, cardholder, and if applicable, asset scan ID, asset name, intercom station, central station alarm receiver, transmitter, or transmitter input. All sorts MUST be able to be accomplished in one mouse click.
z. Allow the System Operator to be able to find the location of the alarm by using a graphical map, the real-time graphical system status tree, or an alarm menu. A map callup feature must be provided that will show the map associated with the alarm. aa. Have a function list(s) assigned to it that will trigger when the alarm is acknowledged.
bb. Require User Logon for Acknowledgment P This feature shall require a user ID and password to be entered when the given alarm is acknowledged. This ID shall be different than the User ID that is currently logged onto the SMS.
cc. Activate an Action Group P This feature shall allow the System Operator to execute an action group, which shall include one or more actions.

53. Alarm Handling: The handling of alarms shall resemble the following steps.

a. The System Operator shall select the alarm or event by any one of the following procedures:
    1) Clicking with the mouse on the system device map icon representing the alarm
    2) Choosing acknowledge from the menu bar
    3) Highlighting the alarm or event in the alarm list by clicking the mouse
    4) Double-clicking on the alarm or event in the alarm list box
b. Any of the above choices shall put the System Operator in the acknowledgment window. The acknowledgment window shall display the time, date, and a user-defined description of the alarm, as well as any emergency procedures. The acknowledgment window shall present the System Operator with the following choices:
    1) Review instructions or procedures to follow for the alarm
    2) Make a journal entry
    3) Acknowledge the alarm
    4) Listen to audio instructions
    5) Print the alarm and instructions to a local printer
    6) Review any previous journal entries for this alarm.

54. Until the alarm is acknowledged, the alarm shall remain in the Main Alarm Monitoring Window and be counted in the alarm status line.
55. System Operators shall have the ability to mark an alarm as 'In Progress', meaning that a System Operator has recognized the alarm and is working on a response. When an alarm is marked as 'In Progress', the SMS shall silence any repeating audio notifications on any Alarm Monitoring Workstation in which the alarm was routed and also remove the alarm sprite notification on any graphical maps that may be displaying the alarm. Other System Operators shall be notified that an alarm has been marked as 'In Progress' by an icon next to the alarm in the Main Alarm Monitoring Window.
56. Control of the associated field hardware device from which the alarm was generated through a right-mouse click operation shall be available. For example, a System Operator can open a door via a card reader alarm. All field hardware device icons on any screen can control the associated field hardware through a right-mouse click operation. A right-mouse click will invoke a menu item with all available control options for that hardware device.
57. System Operators shall have the ability to delete the alarm from the alarm monitoring window without acknowledging the alarm. This feature is useful when guards are monitoring access grants to track where cardholders are moving throughout the facility, but do not necessarily want to acknowledge the alarm.
58. The SMS shall provide a text entry field for the System Operator to enter a journal detailing the cause of specified alarms and the actions taken. The journal shall be mandatory for certain alarms or events per the System AdministratBEUF 7<F6E8G<BA. -;8 journal shall allow System Operators to enter an unlimited amount of notes. Choosing Acknowledge from this window shall clear the alarm indicator and store the alarm information and journal to the database.
59. Other alarms shall be displayed by the SMS while any alarm is being addressed. If another alarm occurs, the alarm pending counter shall increase by one and the new alarm shall enter into the alarm list box prioritized in a sort order as defined by the System Operator. Up to 255 alarm priorities shall be available.
60. The SMS shall allow journals to be retrieved, viewed, and edited on screen to provide the System Operator with the ability to complete unfinished journal entries. Journals shall be saved to the database and to a tape during database backups for a permanent record as required by CUSTOMER regulations.
61. For card reader alarms, the SMS shall allow System Operators to activate, deactivate, or pulse any or all of the card reader outputs configured and associated with the card reader. The System Operators shall also have the ability to mask or unmask each individual card reader door forced open alarms, door held open alarms, and either or both or the auxiliary alarm inputs configured and associated with the card reader.
62. Current Status Indication: The alarm monitoring window shall provide a visual status that displays the current status of all devices in the device tree including child devices downstream from the primary device. Additionally there shall be a numeric display of card readers, ISCs and ICMs that are offline.
63. Pending Alarm Windows: The SMS shall support a Pending Alarm Window in the Alarm Monitoring Workstation. This shall be a separate window from the Main Alarm Monitoring Window that shall be opened at any time to view a list of only pending alarms. The Pending Alarm Window shall be optionally displayed in conjunction with the Main Alarm Monitoring Window. The Pending Alarm Window shall continuously update as new pending alarms are generated and as existing pending alarms are acknowledged or deleted.

Pending alarms shall also display in the Main Alarm Monitoring Window. The Pending Alarm Window shall operate and function in the same manner as the Main Alarm Monitoring Window described throughout this document.

64. Device Group Support: Support device grouping for uniform command and control of groups of devices within the system. Four types of homogeneous device groups shall be supported:
a. Card Reader Groups
b. Input Groups
c. Relay Output Groups
65. Color Coding for Alarm Priorities: Display alarms in the active alarm monitoring window with a flashing colored bar across the alarm based upon priority. Acknowledged alarms may be set with alternate color-coding. A minimum of 255 colors must be available for assignment to a minimum of 255 priority levels.
66. Highlighting of Unacknowledged Alarms: The SMS shall allow for unacknowledged alarms to automatically be displayed in a pop-up window after a user-defined amount of time. The user-defined amount of time shall be set in System Administration.
67. Pre-Defined “Canned” Alarm Acknowledgement Responses: Have the capability for pre-defined alarm acknowledgment responses for alarms in the SMS. An unlimited number of pre-defined responses shall be able to be configured for each alarm in the SMS.
68. Cardholder Record Call-up: From the alarm monitoring window, the System Operator must be able to display a cardholder record with the stored cardholder’s image This feature shall be user configurable to be automatic meaning that the Cardholder Window will automatically appear on the Alarm Monitoring client workstation on cardholder activity and will display the current cardholder’s information with photo. The Cardholder Window will automatically update with updated cardholder information as additional cardholder activity is generated. This feature shall be provided at all alarm monitoring client workstations to assist the System Operator in determining the access rights of an employee who may have forgotten his or her badge or to verify that the individual presenting the card is the correct individual cardholder. Utilizing a database search via the input of the cardholder's name or other key search field, or by selecting a cardholder record call-up from the main monitoring window on a cardholder alarm, the SMS must access the employee's personnel file, containing pertinent information and the employee's image for identification by the System Operator. The System Operator shall not be required to exit alarm monitoring to view this information and this operation must not restrict the operation of monitoring alarms.
69. In the event of an access denied or access granted card reader alarm signal to the alarm monitoring client workstation, this function shall be available as a menu or mouse selection, based on the alarm event. Data input by the System Operator shall not be required. 70. Inactive Badge Alarm: The SMS shall provide an alarm, indicating current badge status, if An attempt to gain access is made with a badge that’s status is set to any other value other than “Active” in the card holder record. Typical inactive badge status values include “Lost” and “Terminated”. Access shall come with this feature disabled, the System Administrator has the ability to enable this functionality.
71. Request to Exit Event: The SMS shall provide an event when a Request to Exit (REX) is used. By default, the SMS shall come with this feature disabled, the System Administrator has the ability to enable this on a reader by reader basis.

72. Cardholder Photo Verification: From the alarm monitoring window, the SMS shall optionally display the stored cardholder photo for each credential presented at the user specified reader(s). This function shall allow an operator to verify that the person using the credential matches the stored photo. The system operator shall be able to select from a list of readers. As the cardholder badges through the selected reader their photo shall appear in the Cardholder Verification window. The system operator shall be able to open multiple Cardholder Verification windows to cover multiple readers at the same time. If the Cardholder Verification window is open when the Alarm Monitoring application is closed then the Cardholder Verification window shall open automatically next time the application is launched.
73. Cardholder, Card Reader, or any Field Hardware Device Trace: From the alarm monitoring window, the System Operator must be able to initiate several traces of cardholders, assets, and/or field hardware devices while monitoring alarms. This information shall be continuously accumulated in the dedicated trace window until the trace is stopped. The trace operations must not interfere with the operation of the alarm monitoring, and be continuous while alarms are monitored. The results of each trace shall be printable on the report printer or displayed on the screen. The traces shall operate independently, such that one trace may stop and start without interfering with another.
74. Trace windows operate independently of each other and the Main Alarm Monitoring Window. Thus, different Alarm Filter sets shall be settable for each alarm window (Main Window and Trace Windows) open in Alarm Monitoring. For example, the Main Alarm Monitoring Window may not monitor Access Grants Events, while one or more of the trace windows are monitoring Access Grants Events.
75. The operator of the SMSUF A?4E@ &onitoring application shall be able to acknowledge alarms from any alarm view window (even if they are no longer present in the Main Alarm Window). The alarm view windows shall include Main Alarm Monitor, Trace Monitors, Pending Alarms, and Video Verification. The SMS shall allow for individual alarm acknowledgement and fast or group acknowledgement.
76. The SMS shall support historical traces. Historical traces shall allow System Operators to specify the date and time range that they would like displayed for the particular device that is being traced. For example, a System Operator may perform a historical trace that shows the last seven days activity at a particular card reader. Events are then added in real-time during and after the database has been searched for historical events. Historical traces shall also have the ability to be run against restored (previously archived) data.
77. The SMS shall allow System Operators to filter alarm types from the history trace window. Alarms that shall be filtered from the trace window are access granted alarms, access denied alarms, system alarms, duress alarms, and area control alarms. If applicable, alarms that shall also be filtered are asset alarms, fire alarms, intercom alarms, central station receiver alarms, video clips, and transmitter alarms.
78. The SMS shall allow for a trace on any ISC, ICM, Alarm Input, Credential, Intrusion Detection Device, Monitor Zone, or card reader to be performed. If applicable, the SMS shall allow for a trace on any asset, intercom, or camera to be performed.
79. Single-Click or Double-Click Device Command Execution: The SMS shall support the ability to execute a device command based on either a single-click or double-click on the field device icon in the System Hardware Status Tree or Graphical Map. For example, double-clicking a card reader icon shall pulse open the door for the configured strike time.

Whether a single-click or double-click is used to activate the command shall be determined on a System Operator basis.

80. 'On the Fly' New Login of System Operators: Allow a System Operator to login over another System Operator who is already logged into the same client workstation. This process shall log the first System Operator off of alarm monitoring and log the new System Operator on, changing any permissions necessary for that System Operator.
81. Auto Exit to Windows 7 or 2008 or 2003 or XP or Vista Login Window: Configurable to automatically exit the Alarm Monitoring application and log the System Operator out of the Windows 7 or 2008 or 2003 or XP or Vista Operating System when a System Operator logs off an alarm monitoring client workstation. The SMS shall then bring the System Operator to the Windows Login Window for the next System Operator to log on.
82. Grant or Deny Popup Window: The SMS shall have the ability to launch a pop-up window when a request for access is made through global input or output activity, such as when an intercom station is linked to a door. Upon activating the intercom, the pop-up window shall be displayed in the Main Alarm Monitoring Window and the System Operator shall then have the ability to issue a grant or a deny for the open door request.
83. Alarm Monitoring P Column Display and Configuration: Allow System Administrators and System Operators to define which columns are displayed in the Main Alarm Monitoring Window and in which order. System Administrators and System Operators shall also be able to determine the column order.
84. Test Mode: Support a Test Mode for Alarm Inputs, Door Forced Open, Access Grants. Tests on Input Device Groups shall be available to verify that all inputs within the group are operational. Upon entering into Test Mode and for the duration of the test, alarms from members of the group shall either be displayed in a separate window or view on test alarm monitoring client workstations or on all Alarm Monitoring client workstations in which the alarms are usually routed. During the test (the duration of the test shall be set by the System Operator), all inputs within the group are manually activated in the field. At the end of the time duration, a report shall be generated flagging any inputs for alarms that were not received. During the Test Mode, all alarm operations carry on as programmed (that is, Global I/O functions, CCTV commands, printer activity, etc.) so that all functions are tested.
85. Manual Control: Provide the System Operator the option to manually control over all output points or input points connected to the SMS. Control points are defined as any door strike, auxiliary card reader output, or any other relay output point of an Output Control Module (OCM).
86. Destination Assurance: Provide the ability to alert the system operator when a cardholder does not reach a required location and present their credential after entering at a designated checkpoint in a designated period of time.
87. Real-Time, Dynamic Graphical Maps:
    a. Support graphical maps that display device or group status, function lists and video cameras dynamically in real-time. The maps may be configured to appear on command or when specified alarms are selected for acknowledgment. Map device icons shall have the ability to dynamically change shape and/or color to reflect the current state of the device. The SMS shall indicate if the field hardware is not operating with the most current version of firmware.
    b. Support all map formats listed below:
        1) Adobe Photoshop (.psd)

2) AutoCAD DXF (.dxf)
3) CALS Raster (.cal)
4) Encapsulated Post Script (.eps)
5) GEM or Ventura (.img)
6) IBM IOCA (.ica)
7) JPEG (.jpg)
8) JIFF (.jif)
9) Kodak Photo-CD (.pcd)
10) Kodak Flashpix (.fpx)
11) LEAD (.cmp)
12) Macintosh PICT (.pct)
13) MacPaint (.mac)
14) Microsoft Paint (.msp)
15) Port Net Graphics (.png)
16) Sun Raster (.ras)
17) Targa (.tga)
18) TIFF (.tif)
19) Windows Metafile (.wmf, .emf)
20) Windows Bitmap (.bmp, .dib)
21) WordPerfect Raster (.wpg)
22) Zsoft PCS or DCX (.pcx, .dcx)

c. Support user-defined icons for field hardware devices. The SMS shall also give System Operators the ability to affect the mode of card readers, open doors, start a trace on a device, mask or unmask alarm inputs, and activate or deactivate or pulse an output from the map icons.
d. The graphical maps shall have the ability to be printed to a local printer.

88. Real-Time Graphical System Status Tree and List Window: The SMS shall support a real-time graphical system status tree or list window that graphically depicts all field hardware devices that are configured in the SMS. The real-time graphical system status tree or list window shall list all ISCs, ICMs, alarm inputs, relay outputs, and card readers. The SMS shall display if the ISCs, alarm input panels, alarm output panels, or RIMs are not currently operating with the most current version of firmware. If applicable, the graphical system status tree or list window shall also list all digital video recorders, video cameras, and intrusion detection devices, zones, and areas. The tree or list window shall show the real time status of all these devices (online vs. offline, alarms activated, masking status, etc.).
89. The graphical system status tree or list window shall include three counters:
    a. Active Counter- a counter of the number of active points in the Monitoring Zone.
    b. Offline Counter - a counter of the number of offline devices in the Monitoring Zone.
    c. Masked Counter - a counter of the number of masked points in the Monitoring Zone.
90. System Operators shall be able to display both list window(s) and graphical system status tree(s). The List Window shall display all hardware devices separately in their own row in the window. The following columns shall exist in the list window: a. Device Name
    b. ISC or ICM or OCM Name c. Current Device Status
91. System Operators shall be able to sort any column in ascending or descending order. System Operators shall also have the ability to choose what types of devices to display in the graphical system status tree or list window. The following choices shall be available: a. Include All Devices

b. Include Specified Devices
   1) Active devices
   2) Offline devices
   3) Masked devices

92. A status bar indicator shall identify the current selections for the list window or graphical system status tree. System Operators shall be able to display multiple graphical system status trees and/or list windows on a single Alarm Monitoring Workstation.
93. The SMS shall give System Operators the ability to acknowledge alarms from the real-time graphical system status tree or list window without going back into the Main Alarm Monitoring Window. The SMS shall also allow System Operators to affect the access mode of card readers, open doors, start a trace on a device, mask or unmask alarm inputs, and activate or deactivate or pulse an output from the tree icons. The system hardware status tree or list window shall have the ability to be printed to a local printer. The SMS shall also allow System Operators to launch a video player to view live video at the video camera selected.
94. Function List icons shall be able to be placed onto the System Status Tree and thus, System Operators shall have the ability to control and activate function lists from the tree.
95. Alarm Masking Group icons shall be able to be placed onto the System Status Tree and thus, System Operators shall have the ability to view the status of the alarm masking groups and control the groups from the System Status Tree.
96. Anti-passback area icons shall be able to be placed onto the System Status Tree and thus, System Operators shall have the ability to control area status (open or closed) from the tree.
97. Automatic Credential Deactivation by Lack of Use: Have an automatic credential deactivation function where a cardholder's credential will automatically deactivate after an extended period of inactivity based upon a predetermined time period. The credential status may be reset by authorized System Operators.
98. Alarm Filtering: Have the capability for filtering out alarm types from the alarm monitoring window. Alarms that may be filtered are access granted alarms, access denied alarms, system alarms, duress alarms, and area control alarms. If applicable, fire alarms, asset alarms, intercom alarms, central station receiver alarms, intrusion detection alarms, video event alarms, and transmitter alarms may also be filtered.
99. Manual Override of Card Readers: Support System Operator overrides of card readers from the alarm monitoring window, graphical maps or the real-time system status tree. Also support the ability to manually set a reader back to default mode.
100. Alarm Masking:
   a. Support the masking of alarms to be controlled on a timezone basis or by manual control.
   b. Support the ability to configure inputs to be "Unable to Mask".
101. Manual Overrides of Alarm Points and Relay Outputs: The SMS shall support System Operator overrides of alarm points and relay outputs configured in the SMS. System Operators shall have the ability to manually mask or unmask an alarm point and/or activate, deactivate, or pulse a relay output from the alarm monitoring window, the graphical maps, or the real-time graphical system status tree.
102. Online Context-Sensitive Help: Provide online context-sensitive help. The help menus shall be available from any window in the SMS by pressing the F1 function key or clicking on the help icon in the toolbar.

103. Sorting Capabilities: Allow System Operators to arrange the way that alarms and/or events in the alarm monitoring window are listed by sorting the alarms and events. Sort criteria shall be based on priority, time or date, ISC, Card Reader, ICM, Input Device, or Cardholder. Additionally alarms and events can be sorted based on asset scan ID, asset name, intercom station, intrusion panel, transmitter, or transmitter input.
104. Alarm aggregation: Alarm aggregation is a mechanism of combining several alarms into a single item (group) based on certain criteria. The SMS's System Administration application shall have an Aggregate option. A user that has permissions to modify alarms shall be able to enable or disable alarms for aggregation. Alarms shall be aggregated in the Main Alarm Monitoring window if the following criteria are met: a. Alarms are of the same type
    b. Alarms are for the same device
    c. The aggregation option is enabled for the alarm type
105. The group of aggregated alarms shall display the number of alarms in the group as a part of the Alarm Description column if the group contains more than one alarm. Additionally, the alarm description shall be displayed using a bold font. All other columns for the group shall display information for the most recent alarm in the group.
106. The SMS's Alarm Monitoring application's operator shall be able to acknowledge or delete a group of aggregated alarms. When acknowledging or deleting a group of aggregated alarms, all alarms in the group shall be acknowledged or deleted. Acknowledge action shall also involve marking in progress. In case of acknowledgment, the progress bar shall be displayed to indicate the progress of the operation.
107. There shall be a Fast or Group Acknowledge command. If the command is applied to one or more groups of aggregated alarms, all alarms from the selected groups shall be acknowledged or marked in progress depending on what option the user selected.
108. Masking of Successful Command Acknowledgements: The SMS shall support the removal of 'success acknowledgements' that are shown in the Main Alarm Monitoring Window after a command has been successfully executed. The SMS shall allow the successful acknowledgements to be removed on a per System Operator basis.
109. Hardware Update Timer: The SMS shall utilize a hardware update timer whereas the System Administrator can set how often system status updates take place. These updates are reflected in the status bar and the real-time graphical system status tree. This frequency shall be defined in one minute increments and shall be changed 'on the fly' by System Operators. Immediate changes in hardware status are reflected immediately in the real-time graphical system status tree.
110. E-mail Interface Option: Support an e-mail interface seamlessly integrated within the SMS Alarm Monitoring application. System Operators shall have the ability to manually or automatically send ASCII text e-mail messages from the Alarm Monitoring application on demand regarding any alarm currently displayed in the Main alarm monitoring window. E-mails shall have to ability to be sent to multiple e-mail accounts if desired. Integrate with Microsoft Exchange Server.
111. Personnel Management and Enrollment:
    a. The SMS shall generate and store personnel records, as well as monitor badge or credential use throughout the facility. These credentials shall be fabricated at any of the SMS enrollment and badging client workstations configured based on data and images that are input and captured at the time of enrollment. Credential images are to be digitized using industry standard JPEG image compression, and printed using a high quality and direct card printing process.

b. Create and Maintain Cardholder Database: A record for each cardholder shall be created in the badging module of the SMS by entering the required data into appropriate data fields. The System Administrator shall be able to define drop-down list box fields for repetitive entered text (for example: Department, Division, Title, Building Number, etc.). Drop-down list boxes shall allow the System Operator a variety of pre-defined choices for data input. The screen design shall be configurable to allow the entry of data in any format desired. The tab order shall be configurable, and the cardholder ID field of up to 18 digits shall be optionally generated by the SMS from either manual System Operator entry, automatic selection of the next available ID, or by use of the cardholder's social security number.
c. Once all fields have been entered, the SMS shall store the applicant's record to the SMS database. These records must be stored in a central database. Updating cardholder data shall be possible at any time by any authorized System Operator. The SMS shall havea field that allows System Administrators to view the last date and time that a cardholder's record has been modified, without running a report. The cardholder form must be user-definable to allow System Administrators to layout the cardholder form.
d. A SMS data import function shall be available to pre-load the SMS with personnel records and industry standard image formats. This import function shall be capable of adding records to the database at any time.
e. The database shall have key fields that are sorted in an index to allow for faster searches. The System Administrator shall be able to designate fields as required and/or unique fields. No record shall be added to the database that does not contain information within the required fields. No record shall be added to the database that contains a duplicate value in a field that was designated as a unique field.
f. Only System Operators with delete privileges (assigned by the System Administrator) shall be able to delete records. Deleting a record shall permanently remove the record from the database (including image files) to free up the disk space for further use.
g. The System Operator shall have the following functions available when enrolling cardholders: choose a badge type, select access levels, enter personal identification numbers (PIN), and/or any other user-defined fields. The SMS shall allow System Administrators the ability to set a default issue code for all first time prints of credentials. The SMS shall also allow System Administrators the ability to auto increment the issue code each time a new Badge is created or to have the System Operator manually enter in a unique issue code each time a new Badge is created. The SMS shall support a minimum of two digits for the cardholder ID issue codes.
h. The SMS shall utilize keyboard or mouse commands that allow System Operators to quickly create a record for any person. The System Administrator shall be able to define drop-down list box fields for the badge type being issued and default values for the other fields based on the badge type.
i. The cardholder form shall also have the option of displaying a cardholder's signature for the record. The cardholder's current Badge information shall also be displayed on the cardholder form complete with Badge ID number, issue code if applicable, activation and deactivation date and time, and the number of times the current badge has been printed.
j. The cardholder form shall also have the ability to display the cardholder's stored images in one of two ways.

1) Photo Display - This option displays the optimum quality photo using the JPEG compressed image stored in the SMS database.
2) No Photo - This option does not show a cardholder photo.

k. The cardholder form shall also display cardholder 'Last Access' information. This field will show the last card reader that the cardholder accessed or attempted to access, complete with a time and date stamp.

112. Modify Existing Field Names of SMS Cardholder Form: The SMS shall provide a method of defining basic user-defined fields. It shall allow System Administrators to rename the standard database fields in the cardholder form of the SMS and move the fields to different locations on the form. Additional functionality shall be available in the advanced Forms Designing and Editing Module.
113. Cardholder Active Badges: A cardholder may possess one or many badges at any one time.
114. If a badge is updated or re-issued, the SMS shall guide the System Operator to first change the existing badge's status to the appropriate classification (de-activate) before a re- issue of the new badge occurs.
115. By utilizing the previously captured image and employee record, the SMS must allow for fast and efficient re-issuance of a badge. As this re-issued badge is printed, the SMS shallupdate its database to remove access rights from the old badge number and activate the new badge number.
116. Each cardholder record shall offer a user-definable activation and expiration date field. The activation date shall be changed by a System Operator to establish a future activation date. A System Operator shall be able to re-activate a card that has been previously de- activated.
117. When issuing a new badge to a cardholder, System Operators shall be able to assign the pre-existing badge deactivation date and time to the badge instead of the default deactivation date and time for new badges. The deactivation date and time may be assigned on a per badge type basis.
118. A badge form will keep a complete history of every badge that was assigned to the cardholder's issue code, badge type, badge status, activation and deactivation dates and times, PIN numbers, embossed numbers, and anti-passback information.
119. Badge status deactivate
120. All active badges can be configured to change to another badge status when the deactivate date has passed. It is possible to configure this system-wide or per badge type. The badge status shall change 24-48 hours after the deactivate date.
121. Multiple Active Badges: The SMS shall support a user configurable Multiple Active Badge feature. This shall allow cardholders in the System to have up to a user-defined pre-determined number of badges active in the SMS at any one time. System Administrators shall have the ability to set the maximum number of active badges allowed in the SMS.
122. Assign Access Levels: At the time a badge is created it shall be possible to have up to 128 access levels assigned to the cardholder's convenience, the System Administrator must be able to define default access levels to be assigned for given badge types. If a System Operator has proper authorization, cardholder access levels shall be modified. When a badge is created with access rights, or modified, that change shall be downloaded to all ISCs immediately upon completion of the change. Record changes for access rights shall affect only the modified record, and shall not require a download of the entire cardholder database.

123. The access changes shall be downloaded to the field hardware as soon as the employee record change is complete. This badge record download shall not effect field hardware operations.
124. When a badge reaches its deactivation date or time the SMS shall automatically deactivate the access rights associated with the badge. All access rights of a badge shall be eliminated after the expiration date. Should the cardholder become authorized for access again, new access rights shall be applicable to the same badge, and re-issue shall not be required. Should an expired cardholder swipe his badge after his card has expired, access shall be denied and an "invalid credential" alarm event shall be generated to the alarm monitoring client workstation.
125. All cardholder information shall be stored for future retrieval or reporting.
126. An access level form shall show System Operators all access levels configured in the SMS and the associated access levels that are assigned to the cardholder's current badge. The SMS shall allow the System Operator to double-click the mouse on any access level to view all of the card reader and timezone combinations that are assigned to that access level.
127. The SMS shall also support access groups, which shall be assigned to cardholders. Access groups will consist of up to thirty two access levels of which shall be viewed by System Operators by clicking on the desired access group.
128. Bulk Assignment or Modification or Deletion of Access Levels: System Administrators or System Operators shall have the option for Bulk Assignment, Modification, and/or Deletion of Access Levels to active badges for a group of cardholders. This feature shall allow System Operators to perform a search of the cardholder database and then apply any additions, modifications, or deletions of access level assignments to all active badges for that group of cardholders.
129. Search Records: The SMS must allow the System Operator to search for records and images using search criteria on any field(s) in the database. The System Operator must be able to enter the search criteria for one or a combination of fields. In addition, partial searches shall be performed. For example, a partial last name search on "Fitz" might return "Fitzpatrick," "Fitzgerald," or "Fitzerbauch." Using a partial name or letter shall return every record in the database that contains that information in its last name field. The SMS shall support basic Boolean logic searches (greater than, greater than or equal to, less than, less than or equal to, equal to). For example, a last name Boolean Search ">B<F" will return to the System Operator all records whose last name begins with the letter C, D, and E. These records shall be viewable sequentially using search keys.
130. The SMS shall allow for the System Administrator the ability to limit the ability of a System Operator to search the database. Thus limiting System Operators, who are using Alarm Monitoring, from searching through records when pulling up the cardholder screen from an event.
131. In a query with no matching records, the SMS must display a message within three (3) seconds indicating that there is no match for the key field information supplied.
132. Bulk Deletion of Cardholder Records: System Administrators shall have the option to perform Bulk Deletion functions for a group of cardholders. This feature shall allow System Administrators to perform a search against the cardholder database and then delete that group of cardholders.
133. Credentials: Support the following credential types and allow for direct Thermal Dye Sublimation printing onto the credential surface.

a. Composite Credentials - 3.375 in. x 2.125 in., UPVC Composite credentials with an ISO standard 30 mil thickness.
b. Proximity credentials: Proximity shall be an access control or identification technology that utilizes radio frequency (RF) circuits in microchip form. The microchips are encoded and transmit the encoded information when activated. The proximity card shall be used with its associated proximity card readers. The SMS shall be provided with the following proximity card design options:
    1) The proximity card shall be a polycarbonate-based card that cannot be run through direct card printers. This card shall offer a clip slot pre-punched.
    2) The proximity card shall be a PVC dual technology card that employs both proximity and magnetic stripe technology. It shall comply with ISO standard for thickness (30 mil). This card shall allow the printing of cardholder record fields including photo directly on the card.
c. Smart Cards P Contact and Contactless:
    1) Contact smart cards shall be utilized for access control or identity verification technology. Through use of an embedded memory chip, protected electronic data shall be stored on the smart card. Standard card configuration shall include cardholder, biometric, and access information. Contact cards shall require insertion into a card reader which interrogates the card via physical contacts. When coupled with a smart card reader, the smart card shall have the processing power to serve as an access control device, for use in network security and physical access control. The SMS must posses the ability to integrate with the ActivIdentity Card Management System. This integration must allow the System Operator the ability to personalize contact smart cards during the badge issuance process. The integration also must allow for communication during such events as badge encoding, activation, deactivation, and deletion.
    2) Support MIFARE® contactless smart card technology. Contactless smart cards shall be utilized for access control and/or identity verification. MIFARE cards, developed by Philips Semiconductors, shall be presented to a card reader for a transaction to take place using wireless transmissions. They shall be passive devices, requiring no built-in power source. Power shall be supplied from energy generated in the coil of the card being places within the radio-wave field of the card reader.
    3) With MIFARE cards, security shall be handled with challenge and response authentication techniques, data ciphering, and message authentication checks. Uniqueness of cards shall be guaranteed through serial numbers that cannot be altered.
    4) Support shall be provided for encoding MIFARE badges with a custom encryption key. This capability will operate in conjunction with readers configured with a matching key, such that these customized credentials will not be recognized by standard MIFARE readers, and standard MIFARE credentials will not be recognized by these customized readers.
    5) The SMS shall support GemEasyLink680 and GemEasyAccess332 or GemProx P2 encoders. Using the GemEasyLink680 and GemEasyAccess332 or GemProx P2 encoders the SMS shall be able to support both 1kByte (8kBit) and 4kByte (32kBit) MIFARE smart cards.

6) The SMS shall support the input of a MIFARE serial number during standalone and inline printing. The SMS shall be able to read the serial number of the MIFARE card during the print process and have it automatically populate the badge ID field.
7) The SMS shall support the creation of genuine, licensed HID format MIFARE badges compatible with standard HID MIFARE readers, without the need to order customized readers from HID.
8) Support shall be provided for the encoding of genuine licensed HID Corporate 1000 format, including full HID Corporate 1000 parity structure, to the HID MIFARE formatted credential.
9) The SMS shall support the creation of vendor-independent Open Encoding Standard (OES) MIFARE badges from completely unprogrammed MIFARE cards. The system shall allow OES badges to be secured with a user-defined MIFARE authentication key for reading, and a different user-defined MIFARE authentication key for writing and modification. The encoding shall be compatible with OEScompliant readers from any manufacturer. In addition to the creation of OES badges, the SMS shall be capable of creating OES re-keying cards that will allow the authentication key of OES compliant MIFARE readers to be reprogrammed without vendor assistance.
10) Support DESfire® contact-less smart card technology. Contactless smart cards shall be utilized for access control and/or identity verification. DESFire cards shall be presented to a card reader for a transaction to take place using wireless transmissions. They shall be passive devices, requiring no built-in power source. Power shall be supplied from energy generated in the coil of the card being places within the radio-wave field of the card reader. With DESFire cards, security shall be handled with challenge and response authentication techniques, data ciphering, and message authentication checks. Uniqueness of cards shall be guaranteed through serial numbers that cannot be altered. The SMS shall support Integrated Engineering SmartID Pro and Phillips Pegoda encoders. Using the encoders the SMS shall be able to support 16k DESFire smart cards.
11) Support HID iCLASS® contactless smart card technology. Contactless smart cards shall be utilized for access control and/or identity verification. iCLASS cards, developed by HID, shall be presented to a card reader for a transaction to take place using wireless transmissions. They shall be passive devices, requiring no-in power source. Power shall be supplied from energy generated in the coil of the card being places within the radio-wave field of the card reader.
12) With iCLASS cards, security shall be handled with challenge and response authentication techniques, data ciphering, and message authentication checks. Uniqueness of cards shall be guaranteed through serial numbers that cannot be altered.
13) Support shall be provided for encoding iCLASS badges with a custom encryption key. This capability will operate in conjunction with readers that have been ordered with a matching key, such that these customized credentials will not be recognized by standard iCLASS readers, and standard iCLASS credentials will not be recognized by these customized readers.
14) Support shall be provided for the encoding of genuine licensed HID Corporate 1000 format, including full HID Corporate 1000 parity structure, to the iCLASS credential.

15) The SMS shall support HID OEM-100 and OEM-150 encoders. Using the HID OEM-100 and OEM 150 encoders the SMS shall be able to support 2k and 16k iCLASS smart cards.
16) US Government Smart Cards: The SMS shall support reading the access control data (FASC-N) from US Government issued Contactless smart cards, including PIV end point dual interface cards, as well as compatible cards such as CAC dual interface cards, so long as the cards conform to the requirements outlined in FIPS-201 and HSPD-12.
17) Support shall be provided for reading the 200 bit BCD FASC-N output of FASC-N readers, and concatenating the Agency Code, System Code, and Credential Code into a full, globally unique 14 character credential number. The concatenated credential number must be the human-readable equivalent of the three fields in a string. Alternative representations are not acceptable.
18) Support shall be provided for reading the 75 bit Wiegand Binary output of GSA approved FASC-N readers, and concatenating the Agency Code, System Code, and Credential Code fields into a full, globally unique 14 character credential number. The concatenated credential number must be the human-readable equivalent of the three fields in a string. Alternative representations are not acceptable.
19) The SMS shall support mapping and importing of the full FASC-N data contained on TWIC (Transportation Worker Identification Credential) and PIV cards. The "Full FASC-N (Hexadecimal)" shall be provided as a field in the FASC-N drop-down in the SMS forms designer tool to map to the full FASC-N data contained on TWIC and PIV cards. TWIC card values shall be mapped to the corresponding cardholder user-defined fields in order to make import possible. A TWIC or PIV import source shall be supported to import the data. If using a TWIC import source, the PIV data shall be imported along with the TWIC Privacy Key and the full FASC-N data. However, if using a PIV import source, only the PIV data shall be imported. A PIN shall be required to import the following PIV data fields: Fingerprints, Facial image, and Printed information. Without a PIN, only these PIV data fields shall be imported: FASC-N, GUID, and Card Expiration Date. The TWIC data shall not require a PIN. It shall be imported into the database for hardware integration use and shall be not visible to the user.

134. Enrollment and Credential Creation - Enrollment:
    a. System Operators shall be able to enroll cardholders on a one by one basis. System Operators will fill in all required fields including name and badge type. The SMS shall Determine a number of attributes based on the cardholder's badge type. These attributes shall be:
        1) Default Deactivation Date or Time - The deactivation date or time shall have the ability be set for a pre-determined number of days, months, or years; or for an exact specified date.
        2) Default Access Levels
        3) Badge Design Layout
        4) Which Printer will Produce the Badge
        5) Information and Encoding Format to be Encoded onto the Magnetic Stripe
135. Based on the badge type selected, additional fields shall be required for data entry above and beyond the standard required fields. For example, a Contractor badge may require the field "Company Representing" to be filled in before the badge can be saved and printed.

a. System Operators shall also enter a Badge ID of up to 18 digits for the cardholder. The cardholder Badge ID shall be determined in one of the following manners:
   1) Manually entered by the System Operator
   2) Automatically generated by the SMS
   3) Use of the Social Security Number as the Badge ID number
   4) Use of EMPID as the Badge ID number

136. Badge ID ranges shall be able to be pre-defined, if desired, by the System Administrator based on Badge Type. For example, the Employee Badge Type may allow Badge IDs to range from 1-49,999 while the Visitor Badge Type Badge IDs range from 50,000-50,999. Multiple Badge ID ranges may be configured for each Badge Type. System Administrators shall have the option of determining how Badge IDs are generated for each Badge Type. For example, the Employee Badge Type shall generate Badge IDs automatically while Visitor Badge IDs must be manually entered into the system at the time of enrollment. Badge ID ranges may be system wide. For example, all Badge IDs(regardless of Badge Type) must fall within a specific range.
137. System Operators shall have the option of utilizing PIN Codes of up to nine digits, embossed numbers, and anti-passback exemptions for each cardholder who is enrolled in the SMS. System Operators shall also assign any temporary access levels for each cardholder that is enrolled.
138. The SMS shall allow for fast and efficient re-assignment of Badge IDs for use for Temporary badges through use of Re-Assignment Wizards. Re-assignment shall be such that the Badge ID shall be stored in the Audit Trail and reported with the cardholder that was assigned to that Badge ID for the specified period of time.
139. Cardholder Image Capture:
   a. Compatible with flash lighting, RGB video cameras, composite input cameras, S-Video input sources, USB sources and digital cameras and allow the capturing of the cardholder image at a minimum resolution of 1024 x 968.
   b. SMS image capture, storage, and hardware compression techniques must be in compliance with the ANSI standard or JPEG (Joint Photographic Experts Group). Cardholder images must be stored as Binary Large Objects (BLOB) within the cardholder record.
   c. Provide the ability to capture a cardholder's image through the use of any industry standard scanner or digital camera that utilizes a TWAIN interface. Images shall be able to be scanned in at up to 16.7 million colors for a true color scanned image. When using a digital camera that supports multiple resolutions, the system shall allow the operator to select the desired resolution.
140. Image Import: Allow for System Operators to have the ability to import a cardholder's image at the time of enrollment. The SMS must support the following image formats:
   a. Bitmaps (.bmp, .dib);
   b. JPEG (.jpg);
   c. JFIF (.jif);
   d. Zsoft PCX or DCX (.pcx, .dcx);
   e. Adobe Photoshop (.psd);
   f. CALS Raster (.cal);
   g. GEM or Ventura IMG (.img);
   h. IBM IOCA (.ica);

i. WordPerfect Raster (.wpg);
j. Macintosh PICT (.pct);
k. Portable Network Graphics (.png);
l. TIFF (.tif);
m. Windows Metafile (.wmf, .emf);
n. Targa (.tga);
o. Kodak Photo CD (.pcd);
p. Kodak Flashpix (.fpx);
q. Encapsulated Post Script (.eps).

141. Auto-crop the Enrollment Photograph: The SMS shall allow the image being captured or imported to be automatically cropped based on the location of the eyes in the captured or imported image. The SMS shall also allow the operator to override the auto-crop with a manual crop window.
142. Crop Window Attributes: The SMS shall allow for the image capture crop window to be both movable and sizable. System Administrators shall have the option to give System Operators the ability to size and/or move the crop window. System Administrators shall have the ability to have the SMS maintain the aspect ratio of the image if the captured image is smaller or larger than the pre-defined image object on the badge.
143. Business Card Scanner Enrollment: The SMS shall support an integrated business card scanner for automatic population of specific visitor information fields. The VMS shall support the Corex CardScan business card scanner.
144. Digital Certificate Management: The SMS shall support Digital Certificate Services to enable System Operators to securely obtain digital certificates for smart card cardholders. The SMS shall allow a System Operator to enroll and issue the smart card to each cardholder during enrollment process. This shall allow the issuing of a Smart Card Logon certificate (which provides authentication) or a Smart Card User certificate (which provides authentication plus the capability to secure e-mail) for the purpose of Smart Card Login to PCs. The Digital Certificate shall allow cardholders to log on to a computer with a smart card, instead of needing to type CTRL+ALT+DEL. The SMS shall be able to link a SMS cardholder account to the cardholder's Active Directory network account.
    a. Smart card readers: The SMS shall support any smart card reader(s) that have been tested by the Microsoft Windows Hardware Quality Lab and have obtained the Windows- compatible logo be installed on Windows 2003 or XP computers.
    b. Supported smart cards: The SMS shall support the Gemplus GemSAFE and Schlumberger Cryptoflex smart cards included in the default Windows 2003 installation.
    c. System Configuration or Network Account Allocation: The SMS shall enforce the allowable number of Network accounts per Cardholder
    d. Linking Network Account to Cardholder Accounts: System Administrators shall be able to link an existing Windows Active Directory Account to an SMS cardholder account. Conversely, System Administrators shall be able to unlink an existing Windows Active Directory Account to an SMS cardholder account.
    e. Manage Certificates: Through services such as DataConduIT, IT Administrators shall provide facilities to notify IT of events in the SMS that would potentially lead to certificates being revoked or suspended. Thus, SMS Certificate Services provide facilities to manually perform following actions on issued certificates:

1) View certificates. The System Administrator shall be able to view certificates issued to a particular cardholder by SMS.
2) Revoke Certificates.
3) Renew Certificates.
4) View Certificate Audit Trail. Each Certificate Authority shall maintain an audit trail of certificate requests and the certificates that are issued until they expire. The audit trail shall record all certificate transactions including failed requests and all of the information contained in each issued certificate. It also shall provide the information that is required to revoke a certificate and add it to the revocation list. System Administrators shall query the audit trail to locate and view information about any certificate request or any certificate that has been issued by the SMS.

145. Card Management System Support
    a. The SMS shall support any smart card reader that has been tested by the Microsoft Windows Hardware Quality Lab and has obtained the Windows-compatible logo to be installed on Windows 2003 or XP Computers.
    b. The SMS shall support ActivIdentity Server, and ActivIdentity Client.
    c. The SMS shall support issuing of a credential with the self-issuance and local issuance model. For self-issuance the credential will be issued a temporary pass code that will allow the cardholder to login to the ActivIdentity Self Service Portal to complete the issuance process. For local issuance the credential will be given a permanent pin number to secure the credential. The credential will also be completely personalized with all certificates and applications, based on the configuration of the CMS system.
    d. The SMS shall support verifying the cardholders fingerprint while the card is being issued. This option shall by configurable as a system wide setting.
    e. The SMS shall read the card serial number during issuance, either inline during the printing process or on a stand-alone PCSC compliant reader or encoder that is connected to the workstation
    f. The SMS shall support the issuance of a card that either has a pending request from a third-party IDMS (Identity Management Server) or create a new request. The issuance of a card based on a previous request, shall be configured as a system wide setting.
    g. The SMS shall support the issuance of a new card and a permanent replacement card. During the issuance of a permanent replacement card the certificates will be transferred to the new card, based on the configuration of the CMS system.
146. Badge Design: Support the ability to create and maintain badge designs. Features shall include the ability to support:
    a. Complete Badge design and Layout tools
    b. Chromakey
    c. Image Import
    d. Ghosting
    e. Signature Capture
    f. Bar code
    g. Smart chip support
147. ID Printers: The SMS shall support double-sided full color printing on those printers in which double-sided full color printing is available. The SMS shall also support edge to edge printing on those printers in which edge to edge printing is available. The SMS shall support high-speed printing on those printers in which high speed printing is available. The

SMS shall also support holographic overlays on those printers in which holographic overlay support is available.

148. Print Limits: The SMS shall allow System Administrators to limit the number of times A cardholder's credential can be printed.
149. Batch Printing: The System Operator must be able to print a credential immediately or continue enrolling cardholders with the intention of batch printing at a later time. The SMS Badging client workstation shall have the ability to print a large volume of badges with a single command using a search command. The System Operator must have the option of printing all badges, printing selected badges, or pre-viewing badges without printing.
150. The SMS shall have a 'log errors' feature for batch printing. This means that the SMS shall skip any Badges that cannot print due to missing information. For example, in a 200 card batch print job, there may be three cards that require information that is not available because the System Operator failed to enter the information. When printing, the SMS shall skip those three cards and print the other 197. A report can later be run to determine what information is missing for the remaining 3 cards.
151. In-line Magnetic Stripe Encoding: Utilizing an in-line magnetic stripe encoding device within the printer, the SMS must allow for magnetic stripe encoding of all its permanent credentials. This magnetic stripe shall conform to ABA Track II and ANSI specifications. The SMS shall allow System Administrators to define attributes for card number, facility code and issue code, as well as starting card number.
152. The SMS shall support a multi-track custom encoding feature. System Administrators shall be able to encode user-defined custom expressions on any of the three (3) tracks of the magnetic stripe of a credential.
153. The following information shall be able to be encoded on any of the three tracks of the magnetic stripe:
    a. Access Control Information
        1) Facility Code
        2) Card Number
        3) Issue Code
    b. ASCII Text
    c. Database Fields
    d. ISO or IEC 7812-1 Check Digit
154. The SMS shall support encoding data onto a JIS II magnetic stripe using JIS II-capable Fargo printers, including the Persona C30, Persona M30, DTC400, DTC550, HDP600, and HDP5000.
155. Image Export: Have the ability to export a captured and cropped cardholder image to an industry standard JPEG (.jpg) file format.
156. Real Time User-definable Image Compression: The SMS must support a real time user-definable image compression utility. The image compression utility shall give System Operators the ability to compare image quality versus compressed image size ratios. This process shall be done in real time and must not require System Operators or System Administrators to go to a program or .ini file outside the program to adjust the ratio. The SMS shall give System Administrators the ability to set SMS default compression settings and give System Operators, with proper permissions, the ability to override those settings. The better the image quality, the larger the image size (affecting hard drive space and speed

of records traveling across the network). 157. Bar code Support: Support the following bar codes: a. Code 3 of 9 (3:1)

b. Code 93
c. UPCA
d. EAN 13
e. EAN 8
f. Code 128 A
g. Code 128 B
h. Code 128 C
i. Codabar
j. PostNet (Zip +4 Postal)
k. Code 3 of 9 (2:1)
l. Interleaved 2 of 5 (2:1)
m. PDF-417 (2D)
n. Code 128 Auto
o. UCC-128
p. MSI Plessey
q. Extended Code 3 of 9
r. Extended Code 93

158. System Management Console: The SMS shall provide a utility that provides system information and access to log files that can be used to aid in troubleshooting SMS issues.
159. System User Feedback Tool: The SMS shall provide a tool to allow the SMS USER the ability to provide feedback from a menu item available in multiple SMS applications. The tool shall launch a Web feedback form that allows the SMS USER to send feedback about the SMS to the MANUFACTURER.
160. Device Discovery Utility
161. The SMS shall provide a Device Discovery Utility (UTILITY). The UTILITY shall allow the ability to discover IP cameras, device servers, access controllers, and wireless access points. The UTILITY shall discover devices in the local subnet as well as across the multiple subnets configured on the network.
162. The UTILITY shall allow searching and discovering IP cameras on a network, specifically for the purpose of identifying the IP cameras' IP addresses. The UTILITY shall be able to search and discover cameras produced by at least six (6) different camera manufacturers.
163. The UTILITY shall allow the ability to discover Lantronix® device servers, LNL-2210, LNL-2220, and LNL-3300 access controllers, and Lenel ILS wireless access points.
164. The UTILITY shall support the ability to turn on or off discovery based on device types and manufacturer. The UTILITY shall support displaying the devices grouped by Brand, Discovery Service, Device Status, and Device Type. The UTILITY shall support displaying the devices sorted by Brand, Model, Version, Command Status, IP Address and Port, Hardware Address, Discovery Service, and Device Type.
165. The UTILITY shall support performing functions (depending on the type of device selected) such as Ping Device, Reboot Device, Check for Default Password, Get Version, Launch Device Web Site, Save Credentials, and Change IP Address.
166. Hardware Devices Notes Field
167. The SMS shall allow users to enter text as notes for the following types of devices:

access panels, readers, video recorders, cameras, fire, intercom, personal safety, receivers, intrusion detection, PLC, POS, and SNMP. These notes shall be available from the SMS's Alarm Monitoring application. The Notes field shall be able to hold a maximum of 1999 characters. The Notes field shall not allow more text to be entered than can be saved. The Notes field shall support Unicode characters for SMS Language Packs.

168. System Administration
    a. System Configuration
169. The SMS shall provide system icons and/or menu selections for each function requiring configuration of SMS options or peripherals (client workstations, field hardware, network functions, communications, reports, etc.). Icon tools bars shall be sizable, movable, and removable. Each form must be in a tab format and shall provide point and click mouse functionality HF<A: R<6BAFS BE 7EBC-down menus to insure configuration is simple. As soon as a function is defined, it shall appear in any other configuration form list that requires that function. The SMS shall support sorting capabilities for multi-column lists. To sort on a multi-column list, the System Operator shall only have to click on the column that is to be sorted.
170. These forms shall be available only to the System Administrator to make system additions or changes to existing configurations. All SMS configuration options and forms shall be documented in the System Administrator's Manual to assist in the selection of options. a. Pre-defined Database
171. System Administrators shall have the option to install a pre-defined database onto their system complete with sample records and configurations. This sample database shall have a configuration that matches that of the VAR demo cases so that VARs can test and troubleshoot the SMS if necessary.
    a. System Configuration Setup Wizards
172. The SMS shall support SMS configuration setup wizards to guide System Administrators through the configuration of the access control module of the system. The setup wizards shall guide System Administrators step by step by asking a series of questions that, when answered, will allow the SMS to automatically configure itself. The setup wizards shall allow for multiple devices to be added in a single command to allow for easy and efficient SMS software setup. There shall be at minimum, setup wizards for Intelligent System Controllers and Card Readers. a. Single Sign-on Support
173. The SMS shall provide support for single sign on capability. Single sign-on shall allow System Administrators or System Operators to authenticate into SMS applications using their Windows domain account.
174. Sign sign-on shall support the following scenarios:
    a. Allow System Administrators or System Operators to interactively run SMS applications without having to enter a username or password. This shall make administration of the SMS easier since maintenance of separate SMS usernames and passwords is not required.
    b. Allow SMS API scripts to authenticate. These scripts shall be run using a Windows account allowing a seamless and secure way to authenticate the account and restricting the script to those actions that the user is permitted to perform.
    c. Password Privileges
        1) The SMS shall allow the System Administrator to configure each client workstation with those applications that may be run on that client workstation. Individual System Operator passwords will further restrict System Operator functions and shall

be specific to each System Operator. Specific System Operator restrictions shall include:

a) Access to screens or functions (for example: alarm monitoring, badge issue)

2) Specific tasks allowed (for example: modify data, view only)
3) Alarm Monitoring functions (for example: clear alarms, output control, traces, reports)

175. If a System Operator is denied access to specific functions, those functions shall not appear (or shall be ghosted) on the System Operator's client workstation or menu bar while that password is logged in. Passwords shall not print in any report.
176. System Administrators and Operators shall have the ability to change their password at any time in the SMS by logging into the SMS with their current password and then changing it through menu options. a. Strong Passwords
177. The SMS shall support the use of strong passwords. a. System Operators
178. The SMS shall support an unlimited number of System Operators at any time. Each System Operator shall be assigned a logon ID and password. Each System Operator shall be assigned permission levels for system administration and configuration functions, Credential Management functions, alarm monitoring functions, digital video management functions, asset management functions, visitor management functions, remote access level management functions, and database field viewing options.
179. The SMS shall be able to provide information on the date and time a new System Operator was created. The SMS shall also be able to provide information on the date and time the System Operator information was last modified. There shall also be a notes field when entering a new System Operator where information in regards to the System Operator can be stored.
    a. System Permissions
180. Every major feature, function, and cardholder page in the SMS shall be permission protected. Each System Operator shall be assigned permission or no permission to use or view or access each feature and function in the SMS. Permission groups shall be broken into three categories: System Administration, Credential Management, and Alarm Monitoring.
181. Every page in the Cardholder Form shall be permission protected. Each System Operator shall be assigned view permissions for each page of information in the Cardholder Form. 182. Every database field in the SMS shall be permission protected. Each System Operator shall be assigned view or edit permissions for each personnel database field in the SMS. 183. Ad-hoc Database Report Generator

184. The SMS must provide an ad-hoc customized report generator package integrated with the SMS's database. This program shall allow the System Administrator to create reports using the relational database structure. Among other reports, a tabular type report shall be configurable which will detail any information from the database in a columnar format with headings, breaks, sub-totals and totals. The report must also be able to be created to produce a flat ASCII export file. Access rights shall be provided to allow the System Administrator the privilege of creating, deleting, updating, saving, processing, viewing and printing reports. The reports are to be printed on a dot matrix printer or on a laser printer. Report configuration shall use menu options and drop-down list boxes to define that database fields are to be used, linked, or joined. They

shall also be used to specify conditions and column order, as well as describe the layout and headings. 185. Custom Report Writer

186. The SMS shall support an industry standard, off the shelf, custom report writer, such as Crystal Reports 11, or 11.5. The custom report writer shall support multiple report types including, but not limited to, multiple section reports, form style reports, conditional reports, query reports, and columnar reports. The custom report writer shall have BLOB Bitmap support and shall come standard with a formula editor with more than 160 built in functions for System Operators to manipulate data. It shall have export capabilities to ASCII files, Microsoft Mail, or ODBC file formats. The custom report writer shall be compatible with industry standard SQL databases, such as Microsoft SQL Server 2005 or Microsoft SQL Server 2008.
187. System Tape Backup
188. A mandatory requirement, the SMS shall provide tape backup and restore programs utilizing the multi-tasking capabilities of the SMS and operating system. These programs shall run concurrently with any other application. Database backup must occur dynamically while other alarm monitoring, badging, access control applications remain active.
189. The tape backup feature shall allow for three levels of tape backup; 1) Incremental, which will back up to tape all changes to data and images that have changed since the last incremental tape backup, 2) System, which will back up the operating system and application files only, and 3) Full, which back ups all files.
190. A database snapshot shall occur prior to a tape backup and the actual backup shall be performed in the background, utilizing the benefits of the multi-tasking operating system, without interfering with the ability of System Operators to exercise other functions.
191. Client workstations
192. System Administrators shall have the ability to configure each client workstation on the SMS to utilize any combination of event printers, CCTV controllers, and video capture boards. For each printer or CCTV controller, System Administrators shall be able to select the port that the device is connected to on the client workstation and the communications speed.
193. PIN Numbers
194. The SMS shall have the ability to support up to nine (9) digit PIN Numbers for each cardholder in the SMS. PIN Numbers shall be created either manually through System Operator entry or generated randomly by the SMS. The SMS shall have the ability to be configured to allow for unique PINs for each cardholder and the ability to modify cardholder's PIN numbers at a later date.
195. List Builder
196. System Administrators shall have the ability to pre-define information that will appear in each of the pre-defined drop-down lists. There shall be no limit to the number of items that shall be a part of a list. Lists can have items added to them or deleted from them at any time.
197. Archiving
198. The SMS shall allow System Administrators to archive offline history files to magnetic media. Offline files shall include access events and System Operator transactions that have been purged from the reportable database. The offline files MUST be in a "ready to import" format for easy insertion of information back into the online database. Different event types may remain in the database for different time periods according to the System Operator's specification.

199. Any record older than the specified dates shall be purged to the offline history file for archiving. Reports shall be generated from the archived files if necessary. Archiving shall be a scheduled, automatic function.
200. Remote Dial-In Capabilities
201. The SMS shall support remote dial-in capabilities for SMS troubleshooting, SMS configuration, and alarm monitoring capabilities.
202. VAR and/or System Administrators shall be able to dial in to the CUSTOMER Database server to troubleshoot the CUSTOMER's system. This will allow System Administrators to locate any problem areas and, many times, fix the error over the telephone from a remote location.
203. Remote dial-in shall also be used for SMS configuration and/or alarm monitoring from remote locations using a client workstation. The client workstation shall have the ability to operate on a Laptop PC that meets the client workstation minimum specifications.
204. Reader Groups

a. The SMS shall support reader groups. The SMS's Grouping form shall be used to: 1) Specify the group or groups to which the reader belongs.
    2) Search for readers by group (The search for readers button is available from all of the forms in the Readers folder.)
    3) Name and save lock group search criteria for future use.
b. Six (6) default reader group drop-downs are provided on the SMS's Grouping form.

205. The SMS shall support a multi-PC, multiple database synchronization architecture (herein after Mobile Enterprise Architecture) using a database server. The database server shall allow multiple wearable or mobile computers to be connected to it (via wired or wireless LAN or WAN architecture). In a stand-alone environment, connections shall occur only during synchronization.
206. The database server shall contain a master copy of all relevant system data. An unlimited number of mobile enterprise client workstations may be connected to the database server.
207. In a stand-alone environment the mobile enterprise computing PC shall contain a copy of all required core information obtained from the database server. This shall include, but not be limited to, cardholders, badges, badge types, and access permissions.
208. Screen Designer Tool

a. SMS Cardholder Standard Fields and Objects

209. The SMS shall support at a minimum the following standard fields for personnel information: 1) Last Name
2) First Name
3) Middle Initial
4) Social Security Number
5) Badge Type
6) Address 1
7) Address 2
8) City
9) State
10) Zip Code
11) Phone Number
12) Birth Date

13) Title
14) Department
15) Division
16) Location
17) Building
18) Floor
19) Office Phone Number
20) Extension
21) Signature
22) Last Reader Accessed
23) Record Last Changed
24) Badge ID
25) Issue Code
26) Number of Prints
27) Activation Date
28) Deactivation Date or Time
29) Badge Status
30) PIN Number
31) Embossed Number
32) Date of Last Badge Print
33) Photo

34) Photo Display

b. SMS Asset Standard Fields and Objects

210. SMS shall support at a minimum the following standard fields for asset information:

1) Scan ID
2) Asset Name
3) Acquired
4) Replace
5) Type
6) Subtype
7) Serial Number
8) Department
9) Assessed Value
10) Replacement Value
11) Last Inspection
12) Next Inspection
13) Record Last Changed
14) Photo
15) Photo Display
16) Last Reader Accessed
17) Assignment Button

b. User-definable Fields

211. Should the SMS standard fields not be suitable, System Administrators shall have the ability to modify any standard field to customize the cardholder, asset, and visitor forms as desired. The SMS shall also allow System Administrators to add custom fields in addition

to or replacement of any standard fields on a minimum of thirty two (32) pages each of information for the cardholder, visitor, and visit forms and one page of information for asset. User-defined fields absolutely shall not be pre-defined, meaning only the labels can change while the properties cannot. System Administrators shall have a minimum of sixteen pages of which to design their screens with standard and custom fields.

a. System Administrators shall have the ability to modify the pages of information in any combination as follows:
   1) Move standard database fields to different locations on the cardholder forms
   2) Delete standard database fields that are not desired
   3) Keep standard database fields in the same location as the factory ships them, but changing the label and/or any field attributes. For example, Zip Code may be changed to Postal Code and the attributes changed from a number field to text field for Canadian Installations
   4) Add new fields to the cardholder forms each with their own unique set of attributes
   b. Field Types

212. The SMS shall support, at a minimum, the following field types:
1) Text Fields
2) Date Fields
3) Numeric Fields 4) Drop-down Lists a. Field Attributes

213. System Administrators shall be able to assign any combination of the following attributes to each field defined:
1) Positioning of the field on the form
2) From which page the field can be viewed
3) From which page the field can be edited
4) The font to be used for the information that will appear in the field. The SMS shall support all standard Windows fonts
5) The style to be used for information that will appear in the field. The SMS shall support bold, italic, both, and regular typeface styles
6) Any effects to be used for the information that will appear in the field. The SMS shall support strikeout and underline
7) Whether the field is required
8) Whether the field is to be indexed
9) Whether the field is unique
10) If a template is to appear in the field
11) If a default value will appear in the field b. Field Styles

214. System Administrators shall be able to assign any combination of the following styles to each field defined: 1) Multi-line field
2) Horizontal Scroll
3) Vertical Scroll
4) Auto Horizontal Scroll
5) Auto Vertical Scroll
6) Enter means next line of text
7) Number
8) Uppercase
9) Lowercase

10) Read Only
11) Align Right
12) Password
13) Sunken
14) Border
15) Inside Edge
16) Raised 17) OEM Covert

b. Field Alignment and Width Tools

215. The SMS shall support the following field alignment tools to allow System Administrators to align fields and set uniform widths to fine tune the look and feel of the screens. The SMS shall allow System Administrators to select multiple objects simultaneously and align them to their desired position and/or set a uniform width. The following field alignment tools shall be able to be used in any combination:

1) Align all objects selected to the far left edge of the farthest left selected object
2) Align all right edges of selected objects to the right edge of the farthest right selected object
3) Align the tops of all selected objects to the top edge of the highest selected object
4) Align the bottom edges of all selected objects to the bottom edge of the lowest selected object
5) Align all selected objects to be vertically centered with respect to each other 6) Center all selected objects
7) Make all selected objects the same width as the smallest object selected
8) Make all selected objects the same width as the widest object selected
9) Make all selected objects the same height as the shortest object selected
10) Make all selected objects the same height as the tallest object selected
11) Evenly space all objects vertically between the two most outer objects
12) Evenly space all objects horizontally between the two most outer objects
13) Bring object to the front of the page 14) Send object to the back of the page a. Tab Ordering

216. The SMS shall allow System Administrators to set the TAB order (the order in which the cursor moves throughout the fields) of the SMS when System Operators utilize the TAB key to move throughout the cardholder form.

217. Map Editor Module

218. The SMS shall support graphical map creation software that shall allow the import of map backgrounds from any standard 'off the shelf' drawing package in the formats listed below:

a. AutoCAD DXF (.dxf)
b. Bitmaps (.bmp, .dib)
c. JPEG (.jpg)
d. JIFF (.jif)
e. Zsoft PCX/DCX (.pcx, .dcx)
f. Adobe Photoshop (.psd)
g. CALS Raster (.cal)
h. GEM/Ventura IMG (.img)
i. IBM IOCA (.ica)
j. WordPerfect Raster (.wpg)

k. Macintosh PICT (.pct)
l. Portable Network Graphics (.png)
m. TIFF (.tif)
n. Windows Metafile (.wmf, .emf)
o. Targa (.tga)
p. Kodak Photo CD (.pcd)
q. Kodak Flashpix (.fpx)
r. Encapsulated Post Script (.eps)

219. These architectural type maps must allow the detailed layout of an entire structure, part of a structure, a floor or department within a building, or layout of the periphery of a facility. Once a map has been drawn, the System Administrator must have the ability to place system level icons of card readers, input and output points, video cameras, and other access control field hardware in the appropriate area to indicate their respective location on the map. This is to be accomplished by simply dragging the icon with the mouse to the appropriate location on the map.
220. The SMS must allow various maps to be associated with each area to provide for the creation of hierarchy of maps. Overview maps of an entire facility shall be able to be viewed as requested and nested maps shall be accessed from the overview map to enlarge a specific area or facility on the screen. Maps shall also support user-defined text that shall be placed onto the map background.
221. The SMS shall allow hardware device icons to be either static or part of a device group. Icons that are part of a device group shall allow the hardware device icon to change shape and/or color based on the current state of the device.
222. Maps shall have the ability to be printed and/or previewed from the Map Editing Module or the Alarm Monitoring application.
223. The SMS shall also support custom device icons to be used with the maps (.ico) files.
224. Import Module: The SMS shall support an import utility, which shall allow the CUSTOMER or VAR to import cardholder information into the SMS database. This shall allow the CUSTOMER or VAR to pre-populate the SMS database with existing cardholder data and/or add NEW records to an existing SMS database. The Import Module only supports SQL Server; it does not support Oracle. For Oracle, DataExchange must be used for data import.
225. The Import Utility shall be a 32-bit Windows application that shall be used to import standard ASCII delimited text files into the SMS. The import utility shall be utilized at the initial SMS setup and anytime a large number of records need to be imported into the SMS after the initial import. For example, a large university may import 10,000 records into the SMS during the initial SMS setup and then import 2,000 additional records each semester thereafter. The SMS shall check for duplicate records during the import, so that multiple copies of the same record are not added into the SMS database.
226. The import utility shall allow System Administrators to choose the delimiter for the ASCII file. This delimiter may be, but is not limited to, a comma, vertical bar, semi-colon, or asterisk. Fields in the SMS database, such as Address 2, that the CUSTOMER does not wish to use, may be left blank in the ASCII file.
227. The import utility shall be able to select the source drive where the ASCII delimited file is located as well as the destination drive where the SMS database is located.

228. The import utility shall also be able to import photos as part of the record into the SMS database. The SMS shall support the following file formats for the import of cardholder photos:

a. Bitmaps (.bmp, .dib)
b. JPEG (.jpg)
c. JIFF (.jif)
d. Zsoft PCX/DCX (.pcx, .dcx)
e. Adobe Photoshop (.psd)
f. CALS Raster (.cal)
g. GEM/Ventura IMG (.img)
h. IBM IOCA (.ica)
i. WordPerfect Raster (.wpg)
j. Macintosh PICT (.pct)
k. Portable Network Graphics (.png)
l. TIFF (.tif)
m. Windows Metafile (.wmf, .emf)
n. Targa (.tga)
o. Kodak Photo CD (.pcd)
p. Kodak Flashpix (.fpx)
q. Encapsulated Post Script (.eps)

229. The SMS shall include a progress meter to show the System Administrator the percentage of the import complete when importing large quantities of records.
230. SMS Server Redundancy

a. The SMS shall support multiple levels of fault tolerance and SMS redundancy listed and described below: 1) Hot Standby Servers
    2) Clustering
    3) Disk Mirroring
    4) RAID Level 10
    5) Distributed Intelligence b. Hot Standby Server Solution

231. The SMS shall support a fault tolerant server and redundant database architecture. It shall allow for normal operations to occur in the event that the Database Server fails. In the event of a server failure, the switch over to a backup server shall be automatic. System Operator intervention for switch over shall not be acceptable.
232. The SMS shall utilize two servers, which shall be configured identically. One server shall be designated as the Primary Server and the other shall be designated as the Backup Server. The Primary Server shall be the main server that is in use when the SMS is operating under normal conditions.
233. The SMS shall mirror the database information from the Primary Server to the Backup Server. This mirroring shall be conducted through standard local area network (LAN) communications. There shall absolutely not be any proprietary communication links between the Primary and Backup Servers.
234. All access control field hardware shall be configured for both the Primary Server and the Backup Server. Both the Primary and Backup Servers shall recognize the same TCP/IP ISC address on the network.
235. If the Backup Server is not running or receiving the mirrored files from the Primary Server, the Primary Server shall save the changes locally. Upon restored communications to the Backup Server, this information shall be automatically sent to the Backup Server.

236. In the event that the Primary Server fails, the Backup Server shall sense that the Primary Server has failed and is no longer on the network. The Backup Server shall check to see if the Primary Server is online every five seconds.
237. Upon sensing Primary Server failure, the Backup Server shall automatically initiate itself as the Primary Server and shall begin communication with the Intelligent Fields Panels. ABSOLUTELY NO SMS OPERATOR INTERVENTION SHALL BE REQUIRED. A message shall be broadcast to all client workstations on the network that the Primary Server has failed and the Backup Server has taken control. This process shall take no longer than two minutes to accomplish.
238. Once the Primary Server comes back online with the SMS, the Primary Server and Backup Server shall be able to be re-synchronized though automatic operation and resume normal operations. The synchronization process shall be fast, efficient, and take no more than five minutes.

a. Clustering

239. The SMS shall support a fault tolerant cluster server architecture. It shall allow for normal operations to occur in the event that the Database Server fails. In the event of a server failure, the switch over to a backup server shall be automatic. System Operator intervention for switch over shall not be acceptable.
240. The SMS shall utilize two servers, which shall be configured identically. One server shall be designated as the Primary Server and the other shall be designated as the Backup Server. The Primary Server shall be the main server that is in use when the SMS is operating under normal conditions.
241. The SMS shall use shared-media technology. This shall incorporate a third piece of hardware (for example: Dell PowerVault), which shall house the hard disk to be referenced by both servers. Since accessible media is dependent upon a third piece of hardware, emphasis shall only be placed upon the health status of the shared-media device. If the status of the shared-media device remains healthy, server up time is of no consequence to data integrity.
242. The shared-media device provides only a single point of failure. If this device fails, then data cannot be accessed. A dual point of failure shall be achieved by incorporating two shared-media devices that are mirrored (for example: two stacked mirrored Dell PowerVaults).
243. All access control field hardware shall be configured for both the Primary Server and the Backup Server. Both the Primary and Backup Servers shall recognize the same TCP/IP ISC address on the network.
244. In the event that the Primary Server fails, the Backup Server shall sense that the Primary Server has failed and is no longer on the network. The Backup Server shall check to see if the Primary Server is online every 5 seconds.
245. Upon sensing Primary Server failure, the Backup Server shall automatically initiate itself as the Primary Server and shall begin communication with the Intelligent Fields Panels. ABSOLUTELY NO SMS OPERATOR INTERVENTION SHALL BE REQUIRED. A message shall be broadcast to all client workstations on the network that the Primary Server has failed and the Backup Server has taken control. This process shall take no longer than 2 minutes to accomplish.
246. Once the Primary Server comes back online with the SMS, the Primary Server shall resume normal operations. a. Disk Mirroring

247. The SMS database server shall protect data against failure of a hard disk or hard disk controller by providing a disk mirroring configuration. The disk mirroring configuration shall allow data to be stored on dual hard disks running simultaneously. When any client workstation or Intelligent System Controller sends data to the database server, it shall be stored to both sets of hard disk drives. In the event any component on one channel fails, the other disk drive continues to operate without data loss or interruption. The SMS shall also send a warning message indicating that one disk drive has failed.

a. RAID Level 10

248. The SMS shall offer a Fault Tolerant Redundant Array of Independent Disks Level 10 (RAID Level 10) with a hot standby disk. RAID Level 10 shall provide redundancy of disk storage, controller channels and power supplies. Each array must contain a disk drive, high efficiency power supply, and cooling fan. This technology shall use multiple drives to store data with distributed parity, thereby ensuring data protection in an environment in which data is safe and easily restorable in the event of a hard disk failure. In the event a single drive within the array fails, a "Hot Standby Hard Disk" shall be available online and automatically switched with the failed unit.
249. The network administrator shall be able to replace the failed drive without taking the database server down, and it shall then become the hot standby. The array software shall rebuild the lost data from parity information stored on the other drives in the array. This entire procedure shall have no effect on the operation of the SMS and shall be automated.
    a. Distributed Intelligence
250. In the event SMS communications is lost or the database server fails, Intelligent System Controllers shall provide complete control, operation and supervision of all monitoring and control points. The ISC shall be configured with a UPS battery, which shall support the ISC for a 24 hour duration. The ISC shall be installed with enough memory to support up to 10,000 cardholders/100,000 events in a minimum configuration and be expandable to up to 250,000 cardholders/1,000,000,000 events.
251. The SMS shall incorporate performance tests and precautions so as to avoid SMS failure. In the event of a failure, transactions are to be stored in an ISC First In First Out (FIFO) buffer until the ISC comes back online, at which time all data is uploaded to the database server. The ISC shall register as online with the database server when communications are re-established. Should the ISC buffer fill and events are overwritten, an event will appear in the Main Alarm Monitoring Window notifying the System Operator that events were overwritten. The ISC shall send a time/date stamp of the last record or table update in its memory and request any new data changes or cardholder records which have changed since that time or date stamp. A complete download of database and access tables shall not be required because of offline operation.
252. Open Protocol Interface
    a. The SMS shall provide a set of standard Application Programming Interfaces (API's) and supporting documentation that allows hardware manufacturers and software application developers to interface their products into the SMS. The Application Programming Interfaces shall allow requests to occur from CUSTOMER to interface a third-party hardware or software solution based on SMS open architecture and SMS device independence.
    b. There shall be two components to the Application Programming Interfaces. There shall be a device interface and an application interface.
    c. The device interface shall allow extensibility to the number and types of hardware devices supported by the SMS. Each individual piece of hardware shall have its own

"driver" that shall understand how to communicate with the SMS hardware. These "drivers" or "device translators" shall translate a set of generic commands into specific device commands.

d. The device translators shall be implemented as COM (Component Object Model) objects so that they shall be loaded and unloaded as needed. Each device translator shall support certain interfaces that support a specific set of commands or methods. Some examples of typical interfaces could include an Access Control Interface for access control hardware, a Video Interface for DVR and NVR hardware, an Intercom Interface for intercom systems, an Intrusion Interface to support alarm inputs, etc. A particular device translator shall support many interfaces.
e. The main application that shall be used to control the various device translators is the SMS Communication Server (SCS). The SCS shall be the application that manages and sends the commands to the device translators. Other modules including Alarm Monitoring or System Administration shall communicate with the hardware devices by sending commands to the SMS Communication Server, which shall then send the commands on to the correct device or devices.
f. The device interface shall allow the software interface of any hardware device to be controlled and monitored via the SMS Alarm Monitoring application. This shall preserve customer investments in existing equipment as well as allow for system expansion to occur through the interface of the latest hardware technologies.
g. The application interface shall allow information to be exchanged between the SMS and other applications. The application interface shall provide the functions for interacting with the SMS. This includes the ability to extract information from the SMS database as well the ability to download, control and monitor information for all field hardware including access control panels, digital video systems, fire panels, alarm panels, intercom system, etc.
h. All functions of the application interface shall be defined in such a way that any Windows application or development environment with the ability to make "C" calls should be capable of making use of the API.

263. Open Supervised Reader Interface

a. The SMS shall provide connectivity to proximity and smartcard readers which provide continuous supervision and monitoring of reader processor and wiring integrity by means of a non-proprietary communications protocol standard. Supervision methods that simply supervise wiring or measure current draw are not acceptable, since they do not insure that the reader's microprocessor is actually operational. Likewise, proprietary protocols which are sole sourced or licensed for a fee are not acceptable, since they limit potential future expansion options for the SMS.

C. The preferred protocol is the Open Supervised Device Protocol (OSDP), since it is non-proprietary and meets the requirements stated above. Alternative supervised reader interface protocols will be considered only if they meet all of the technical requirements of this section AND can be shown to be non-proprietary.

END OF SECURITY MANAGEMENT SYSTEM

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SECTION 28 20 00

CCTV SURVEILLANCE SYSTEM - IP

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of work is indicated by the requirements of this section. This specification describes the CCTV Surveillance System to be installed with the requirements and qualifications herein listed.

B. Furnish system complete.

C. Furnish all necessary components and hardware for a complete working system.

D. This specification is intended to provide the CCTV Equipment Contractors with the information and details to be used as the basis for the work described herein.

E. Systems shall be installed under Electrical Section with Electrical Contractor furnishing conduit and requirement power, wiring and pulling wire for CCTV Equipment Contractor, CCTV Equipment Contractor shall make all connections.

F. In many instances only major equipment items are specified and other components and hardware may be required to provide a complete working system.

1.2 SYSTEM DESCRIPTION:

A. This section describes the requirement for electronic surveillance. The system utilizes Closed Circuit Television Camera located as shown on the plans to survey designated areas. Video Signals are processed and displayed on monitors located in the control room and office.

1.3 APPLICABLE CODES AND STANDARDS:

A. U.L. Labels - Provide equipment which has been listed and labeled by Underwriter's Laboratories.

B. FCC Compliance - Comply with Federal Communications Commission Class "B" limits set forth in Subpart "J" of Part 15.

C. NEMA Compliance - Comply with National Electrical Manufacturers Association Standards as applicable.

D. NECA Standard - Comply with applicable portions of the National Electrical Contractors Association's Standard of Installation.

1.4 QUALITY ASSURANCE:

A. Equipment Supplier shall be authorized factory service representative for equipment supplied. Supplier shall maintain an office and service facility with factory trained personnel within fifty (50) miles of the site and provide service within twenty-four hours.

B. The Equipment Supplier's factory trained personnel shall directly supervise the entire installation, connections and tests. Supervision shall include on-the-job instructions for the installation and periodic testing. Final installation and connections for control consoles, equipment cabinets, cameras, etc., shall be made by the Equipment Supplier's trained personnel.

C. Before acceptance, manufacturer's representative will test and certify that the system is installed and functioning properly as intended by drawings and specifications. Test shall include operation of all devised and functions in entire system.

1.5 SHOP DRAWINGS AND CCTV CONTRACTOR WORK:

A. Unless otherwise indicated, provide items required for the complete CCTV Surveillance System as follows:
1. Install and connect all CCTV System equipment as indicated on the drawings.
2. Submit equipment/wiring floor plan layout, detailed terminal wiring diagrams, and equipment manufacturer data sheets prior to any installation of delivery of any equipment to the job site.
3. Provide approved copies of shop drawings which show correct device locations and quantities, correct conduit sizes, and cabling and conductor requirements to the other trades providing related work, supervise and work performed by these trades to assure a workable, completed system.
4. Upon completion of all work, a complete functional test of the entire system shall be performed, and if the system is fully operational, a final acceptance test shall then be scheduled with Owner's designated representative.
5. Provide personnel familiar with the installation and with full access to the system for the final acceptance test.
6. Correct punch list items resulting from the final acceptance test.
7. Provide a one (1) year test and inspection service contract as hereinafter defined.
8. Provide a one (1) year job site guarantee on all material and labor furnished.
9. Provide for any additional conduit of increase in conduit size which are required to make the proposed system functional, but which is not indicated on the design drawings.
10. Furnish all low voltage multi-conductor jacketed cables and low voltage central power conductors as required for a complete and workable system.

1.6 COMMON MANUFACTURER:

1. Equipment furnished in any one category shall be supplied from one manufacturer. For example, all cameras must come from the same manufacturer and all monitors, of the same size, shall be from one manufacturer.
2. Video equipment supplied with same model number shall be of the same series.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS:

A. All model numbers listed within this proposal are for equipment manufactured by Pelco. Equal products by Bosch will be acceptable.

2.2 IP VIDEO MANAGEMENT SYSTEM

A. The IP video management system shall consist of Digital Sentry® NVs version 7 software operating on an optimized Pelco-supplied hardware platform. The NVs software shall consist of

base software with individual, non-expiring licenses in the required quantity.

B. The IP video management system software updates shall be downloadable from a publicly available website.

C. The IP video management system shall support up to 128 combined IP and analog video streams, with up to 64 direct-attached analog cameras. Analog streams shall be supported using Pelco and/or third-party encoders.

D. The IP video management system shall provide 280 Mbps throughput for recording of analog and IP video streams, playback and export.

E. The IP video management system shall support recording of JPEG, MPEG-4 and H.264 IP streams.

F. The IP video management system shall support Pelco and third-party H.264 Megapixel video streams up to 10 Megapixel resolution with quantities based on a total system of 280 Mbps throughput for recording of analog and IP video streams, playback and export.

G. The IP video management system shall have a fully open architecture with support for both IP-specific camera as well as cameras with ONIVIF compliance.

H. The IP video management system shall support automatic detection of Pelco IP cameras. Third-party IP cameras shall be automatically detected dependent on IP driver versions and manufacturers specifications.

I. The IP video management system shall support up to 64 looping analog camera inputs with direct-attached 16-channel encoders; up to four direct-attached units. The direct-attached 16-channel encoders shall support H.264 compression, CIF, 2CIF, and D1 resolutions at maximum 30ips, 16 audio inputs and RS422/485 PTZ control with Pelco P and D protocols.

J. The IP video management system shall support an unlimited number of systems connected over a network. Each system shall contain two 1GB network ports; one for IP camera/encoder data, and one to connect to a network for client computer access.

K. The IP video management system shall be viewed, managed, and played back through a single user interface simultaneously with other Digital Sentry digital video management systems through supplied DS Admin or DS ControlPoint Client software.

L. The IP video management system shall operate on a 2nd Generation Intel® Core™ i7 processor and 8 GB of RAM.

M. The IP video management system shall utilize a Windows® 7 Ultimate 64-bit operating system.

N. The IP video management system shall support and have an option for an internal DVD+/-RW.

O. The IP video management system shall contain two DVI-D ports.

P. The IP video management system shall allow expansion of IP video channel capacity through a licensing without any hardware modification.

Q. The IP video management system shall support multiple models of IP cameras and encoders including Pelco cameras and encoders with Sarix technology and multiple third-party manufacturers.

R. The IP video management system shall support audio recording from Pelco cameras with Sarix technology in addition to third-party manufacturer's audio recording.

S. The IP video management system shall support recording the internal server with additional storage utilizing SCSI attached Pelco DX8100-HDDI storage.

T. The IP video management system shall be capable of continuous scheduled alarm/event and motion recording. Pre- and post- alarm recording shall also be available and shall be fully programmable on a per channel basis.

U. The IP video management system shall allow archival of video data to computers or SAN storage devices over a network connection with the optional DS Archive Utility. The archival schedule shall be either automatic at user-defined intervals or manual and shall be configurable per connected camera.

V. The IP video management system shall support network health and monitoring utilizing third-party SNMP monitoring tools.

W. The IP video management system shall indicate system performance and operation status utilizing a variety of HTML reports.

X. The IP video management system shall display system health monitoring data utilizing front panel LED displays and display popups.

Y. The IP video management system shall optionally support on-board video analytics in quantities of two or four channels with Active Alert software and the DS DataPoint interface. The DS DataPoint interface shall provide video analytics monitoring including tracking and counting objects and people.

Z. The IP video management system shall support Lightweight Directory Access Protocol (LDAP).

AA. IP Video Management Client Software requirements

1. The IP video management system shall provide the capability of running a client application in additional to the video management system.
2. A client computer with system compatible software shall be the user interface for viewing one or more systems. Live and recorded video and current event video shall be displayed on any client computer using a proper login and password. The client computer shall be able to connect to an unlimited number of recorders simultaneously to display live and recorded video.
3. Client Software shall be unlicensed and available to be installed on as many clients as required by the user.
4. Client Software shall be compatible with multiple DVR and NVR platforms to include all Pelco Digital Sentry®, Pelco DX8000/DX8100, and Pelco DX4100, DX4500/DX4600, DX4700/DX4800.

5. Client Software shall be password controlled such that password functionality set at each connected system will be recognized at the client. Password shall limit the ability to access live or recorded video as well as the ability to export video.
6. Client Software shall allow multiple monitor support for up to four displays per client workstation, providing virtual matrix functionality.
7. Client Software shall allow the connection of Pelco KBD5000 keyboard controllers to the client workstation to control PTZ operations and camera call-up.
8. Client Software shall allow video streams to be selectable from a system tree on an individual camera, individual system, client defined local groups, or from predefined recorder based groups.
9. Client Software shall be a tab based work environment with the ability to undock the tabs creating a virtual workspace on single or multiple monitor clients.
10. Client tabs shall include system management, live, and search options. Tabs can be displayed simultaneously on the client.
11. Systems Tab shall display and sort available systems, connection status, system names, system IP addresses, and custom categories. This tab shall additionally allow:
    a. Manual connect and disconnect of systems to the client
    b. Virtual systems naming
    c. Auto Connecting
    d. Adding, deleting, and editing available systems
    e. Live video tab shall have the ability to be created up to four times on a single client workstation providing for video display combinations and simultaneous video streams from as many different systems with consideration for maximum client bandwidth.
12. Live video tab shall provide the following functionalities:
    a. Quick Review which shall display recorded video from the last 1, 5, 15, 30, 60 or 90 minutes, providing near instantaneous review of recent events
    b. One week graphical display of recorded video
    c. Borderless display option
    d. Screen layout selection
    e. On the fly on-screen display changes including time, date, camera name, frame rate, frame size, alarm display, and border indicators
    f. Digital zoom
    g. User selectable in-video PTZ control or dashboard style control
    h. Drag and drop audio support associating any audio with any video
    i. Search video tab shall allow for the search of one or multiple cameras from one or multiple systems simultaneously. Search tab shall provide the following functionalities:
    j. Time and date search
    k. Advanced data search with DataPoint interfaced software to Active Alert Intelligent Video and POS
    l. Drag and drop audio support to associate audio with any video
13. Video export to any system accessible media including locally to HDD, CD/DVD, Flash USB device or to network storage
14. Video authentication of exported video via check sum verification
15. Alarm video tab shall allow for alarm pop-up and playback of active alarms. Alarms may be based on motion activity, an external software trigger from Active Alert analytics or a preset data alarm from DS DataPoint. An alarm list pane shall be displayed for playback of queued alarms.
16. The Client shall incorporate virtual matrix functionality whereby camera sequences may be created on the monitoring workstation with the following functionalities:

17. Each sequence shall have a maximum of 500 cameras
18. Each camera in the sequence shall have its own individual dwell time, from 1 to 60 seconds
19. Each entry in a sequence shall have the capacity to trigger PTZ camera presets, patterns, or auxiliaries
20. The Client shall have the capability to display recorded video with full VCR controls. This feature shall display video from multiple cameras simultaneously. The user shall be able to play video as fast as possible (all images), in real time, or by skipping a selectable number of seconds
21. The Client shall support simultaneous playback of up to sixteen cameras all synchronized with each other. Non-synchronous playback of multiple cameras shall not be acceptable
22. The Client shall support tours of multi-camera displays
23. Remote Client Minimum PC Requirements
    a. Processor: 2nd Generation Intel® Core i7 processor with integrated graphics
    b. Memory: 4 GB or higher
    c. Graphics Card: Graphics controller card with 512 MB (or greater) dedicated video memory
    d. Optical Drive: DVD
    e. Operating System: Windows 7 (32 or 64 bit)

BB. Network Server Video Recorder/CCTV Workstation
1. Shall be Pelco DSSRV-030-US
2. Supplied Accessories
    a. Power Cord
    b. USB Keyboard and Mouse
    c. Two (2) Bezel keys
    d. Rack Mount Kit (Brackets, rails, and hardware for rack mounting)
    e. DS-SRV-LIT (Documentation, resource and recovery disc)

CC. System Accessories
1. DS-SW-CAM: Includes eight IP licenses for Pelco and third-party IP cameras Additional DS-SW-CAM licenses can be purchased separately
2. ENC5416: Direct-attached analog encoder
3. DS-SRV-RAID: LSI 3Ware 9750-8i RAID controller card
4. DS-SRV-SCSI : Adaptec® SCSI Card 29320LPE
5. ENC5400-2PORT: 2-port host card (analog) connects 2 ENC5416
6. ENC5400-4PORT: 4-port host card (analog) connects 4 ENC5416
7. KBD5000 Keyboard: Desktop keyboard with control pods provides lens, iris and focus control; playback and menu navigation; and monitor control of one DS ControlPoint tear-off tab.

2.3 VIDEO ENCODERS

A. The video encoder shall be standards-compliant and provide a fully supported API that shall integrate with multiple video management systems.

B. The video encoder shall support 1, 2, or 4 camera inputs.

C. The 1- and 2- input video encoders shall support Power over Ethernet (PoE), 802.3af for the 1-input encoder and 802.3at for 2-input encoder. The 4-input encoder shall be powered by a

12VDC source.

D. The video encoder shall generate compressed H.264 video streams in standards-compliant baseline profile, main profile, or high profile. For 4CIF resolution, the encoder shall employ de-interlacing technology to support interlaced cameras while remaining compatible with standards-based decoders at baseline profile.

E. The video encoder shall provide for two independently configurable streams for each camera input. Each stream shall be capable of 4CIF resolution, 30 or 25 images per second (ips), NTSC or PAL. The settings of one stream shall not interfere or limit the settings for the second stream.

F. The video encoder shall be capable of generating 4CIF resolution, real-time video streams while also running intelligent video content analysis algorithms on each camera input. There shall be no need to degrade video resolution or frame rate to execute analytics algorithms.

G. The video encoder shall provide support for running any three Pelco video content analysis algorithms simultaneously on each channel. In addition, the encoder shall also be capable of processing video content analysis algorithms from Object Video.

H. The video encoder shall have provisions for a micro-SD card for each channel input. The video encoder shall be capable of recording JPEGs for alarm conditions on customer-supplied SD cards.

I. The video encoder shall support daisy chaining up to 4 encoders together to minimize the number of network ports utilized on a switch.

J. The video encoder shall provide for 1 line level audio input per video input. The 1- and 2-input encoders shall also provide for a single, line level audio output.

K. The video encoder shall provide for 1 alarm input per camera input. The encoders shall also provide a single relay output per unit.

L. The 1- and 2-input encoders shall support looping video outputs with software-controlled termination.

M. The video encoder shall support PTZ cameras by way of Coaxitron or Pelco D protocol through a serial connection to the RS422 port.

N. When used with Endura, the video encoder shall be capable of digitally signing each frame of video to guarantee the authenticity of digital video all the way back to its source.

O. The video encoder shall support SNMP diagnostic messages and traps and shall be compliant with SNMP versions 1 and 2.

P. The video encoder shall use a standard web browser interface for remote administration and configuration of encoder and camera settings. The browser interface shall support multi-screen remote monitoring for cameras attached to other encoders or Pelco cameras with Sarix technology on the same network subnet.

Q. The network camera shall provide an additional processor for running Pelco Video analytics.
1. Pelco Analytic Suites shall be configured and enabled using a standard Web browser.
2. Pelco Analytic Suites shall allow remote operation and alarm notification when used with an Endura system or a third-party system that supports Pelco's Analytics API.
3. Pelco Analytics for Network Encoders including:
   a. Abandoned Object: Detects objects placed in a defined zone and triggers an alarm if the object remains in the zone longer than the user-defined time allows. An airport terminal is a typical installation for this behavior. This behavior can also detect objects left behind at an ATM, signaling possible card skimming.
   b. Adaptive Motion: Detects and tracks objects that enter a scene and then triggers an alarm when the objects enter a user-defined zone. This behavior is primarily used in outdoor environments with light traffic to reduce the number of false alarms caused by environmental changes.
   c. Camera Sabotage: Detects contrast changes in the field of view. An alarm is triggered if the lens is obstructed with spray paint, a cloth, or a lens cap. Any unauthorized repositioning of the camera also triggers an alarm.
   d. Directional Motion: Generates an alarm in a high traffic area when a person or object moves in a specified direction. Typical installations for this behavior include an airport gate or tunnel where cameras can detect objects moving in the opposite direction of the normal flow of traffic or an individual entering through an exit door.
   e. Loitering Detection: Identifies when people or vehicles remain in a defined zone longer than the user-defined time allows. This behavior is effective in real-time notification of suspicious behavior around ATMs, stairwells, and school grounds.
   f. Object Counting: Counts the number of objects that enter a defined zone or cross a tripwire. This behavior might be used to count the number of people at a store entrance/exit or inside a store where the traffic is light. This behavior is based on tracking and does not count people in a crowded setting.
   g. Object Removal: Triggers an alarm if an object is removed from a defined zone. This behavior is ideal for customers who want to detect the removal of high value objects, such as a painting from a wall or a statue from a pedestal.
   h. Stopped Vehicle: Detects vehicles stopped near a sensitive area longer than the user-defined time allows. This behavior is ideal for airport curbside drop-offs, parking enforcement, suspicious parking, traffic lane breakdowns, and vehicles waiting at gates.
4. Pelco Analytic Suites shall be preloaded or configuration and alarm notification when used with an Endura® system or a third-party system that supports Pelco's Analytics API.
5. Multiple Pelco behaviors can be scheduled to work during a certain time or condition.

R. ObjectVideo® Analytics for EP High Definition Digital Network Cameras

1. ObjectVideo (OV) intelligent video analytics technology shall be embedded in Pelco EP network cameras with Sarix technology, enabling rule configuration and alarm notification when using OV Ready™ systems.
2. OV analytics shall be made available in three suites: OV Security Suite, OV Security Suite Plus and OV Event Counting Suite. These suites shall provide a spectrum of settings to allow use of the behaviors in a variety of applications. The technology shall help users identify situations of interest, such as surveillance and business effectiveness analysis.
3. OV Security Suite shall include Tripwire Detection, Inside Area Detection, and Camera Tamper Detection behaviors: Tripwire Detection shall identify objects that cross a user-defined line drawn within the camera's field of view; Inside Area Detection shall identify

objects entering, appearing, or moving within a user-defined area; and Camera Tamper Detection shall detect changes in the camera field of view, including obstruction of lens (such as by cloth, spray paint, or a lens cap cover) and unauthorized movement of the camera.

4. OV Security Suite Plus shall include (in addition to all behaviors of the Security Suite) Multi-Line Tripwire Detection, Loitering Detection, and Leave Behind Detection behaviors: Multi-Line Tripwire Detection shall track objects that cross two defined lines, which can be defined by parameters such as direction, sequential order, and the time it takes to cross both tripwires; Loitering Detection shall analyze how frequently people remain for a specified period of time within a defined area, allowing for real-time notification of suspicious behavior around ATMs, stairwells, and school grounds; and Leave Behind Detection shall detect objects placed in a defined zone and trigger an alarm if the object remains in the specified zone longer than the user-defined time allows.
5. OV Event Counting Suite shall use advanced object calibration and additional features for schedules, parameters, and multiple rules. The suite shall include behaviors for Tripwire Counting, Enters/Exits Counting, Loiter Counting, Occupancy Sensing, and Dwell-Time Monitoring: Tripwire Counting shall count people or objects that cross a user-defined line; Enters/Exits Counting shall calculate the number of people that enter and exit an area without using a tripwire; Loiter Counting shall calculate people who stop in front of a defined area of interest (such as a display or product); Occupancy Sensing shall count people, generating a new value every time the occupancy level changes and time stamping each occupancy output, allowing the data to be used to determine average occupancy levels or to correlate data to point-of-sale or other business scenarios; and Dwell-Time Monitoring shall determine the time between which an object enters and exits an area, provide queue size information, and allow assessment of wait times.

S. Model Number
   1. Pelco NET5400 series, Video Encoders

2.4 INDOOR DIGITAL (IP) NETWORK MINI DOME CAMERAS

A. Shall be Pelco IMS0LW10-1 Sarix indoor fixed IP mini dome camera with SureVision, 0.5 Mpxl, low-light, WDR, day/night, 2.8~10mm varifocal megapixel lens, clear dome

2.5 EXTERIOR (WEATHERPROOF) DIGITAL (IP) NETWORK MINI DOME CAMERAS

A. Shall be Pelco #IM10DN10-1E Sarix environmental, indoor/outdoor mini fixed dome IP camera 1.3 Mpxl, day/night, 2.8~10mm varifocal megapixel lens, clear dome with #WMVE-WR/IM-VEPM vandal-resistant wall-mount with pendant accessory

2.6 HIGH DEFINITION CCTV MONITOR

A. The CCTV monitor shall offer the following features: VGA, DisplayPort, and digital visual interface (DVI) inputs, looping BNC output, full high definition resolution, and 32” (minimum) LCD display.

B. The LCD monitor shall provide picture-in-picture (PIP) capability.

C. The Narrow Bezel LCD monitor shall be capable of providing a minimum of 1920 x 1080p native resolution.

D. Model Number
1. Pelco PMCL532F with PMCL-WMT tilt/swivel wall mount

2.7 EQUIPMENT RACKS

A. All digital recorders, video encoders, patch panels and other similar equipment shall be mounted in standard data racks at telephone backboards. CCTV system supplier may utilize space within rack furnished by the Structured Cabling Contractor if available, or may furnish a separate wall-mounted, hinged rack meeting the requirements of the Structured Cabling System specifications section.

2.8 CABLING

A. All Ethernet cabling to cameras shall be yellow, Cat6.

B. Refer to plans and the following specifications sections for cabling requirements:
1. Section 27 05 00: Auxiliary System Cables, 0-50V
2. Section 27 10 00: Structured Cabling System

2.9 MISCELLANEOUS AND OTHER EQUIPMENT

A. Furnish all miscellaneous hardware, connectors, wire/cable and components required for complete functioning system.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Work under this section shall be of professional quality with emphasis on neatness and workmanship.

B. Guarantee workmanship and/or material executed under this division for three (3) years after final acceptance. In the event that project is occupied or systems placed in operation in several phases at Owner's request, guarantee will begin on date each system or time of equipment is accepted by Owner.

C. Focal length of lenses for various cameras shall be determined on site, as well as exact positions of camera. Contractors shall supply portable equipment, camera, monitor, and assorted lenses for field test to make determinations. Test shall be scheduled with, and made in the presence of, the Owner's Representative and the Engineer.

D. All Cat6 cabling shall be installed by the Structured Cabling Contractor per Specification Section 27 10 00. Refer to Specification Sections 27 05 00 and 27 10 00 for additional cable installation requirements.

3.2 OBSERVATIONS OF WORK AND DEMONSTRATION OF OPERATION:

A. Final inspections shall include, but are not limited to, a demonstration to the Engineer and Owner's Representative of all functions and controls of system being tested. Architect's column on test plan will be executed during final. Sufficient Sub-Contractor personnel shall be on site to demonstrate systems. Personnel shall be knowledgeable about all system hardware and software where applicable.

END OF SECTION 28 20 00

SECTION 28 31 00

FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall furnish and install a complete low voltage, automatic and manual fire alarm system as specified herein and indicated on the drawings.

B. The system shall include a central control panel, power supply, signal initiating devices, audible and visual alarm devices, a conduit and wiring system and all necessary accessories required to provide a complete operating system.

C. The system shall be completely addressable.

D. The system shall comply with the applicable provisions of the National Fire Protection Association Standard Number 72 (National Fire Alarm Code) for fire alarm systems; N.E.C. Article 760; and meet all requirements of the local authorities having jurisdiction.

E. The system shall be provided by a local service organization located within 50 miles of the job site.

1.2 DESCRIPTION OF SYSTEM

A. Conduit, outlet boxes, cabinets, devices and wiring installation for complete fire detection and alarm system.

B. Each and every item of the Fire Alarm System shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriter's Laboratories, Inc. (UL), and shall bear the "UL" label. All control equipment shall be listed under UL category UOBZ as a single control unit. Partial listing shall not be acceptable. System controls shall be UL listed for Power Limited Applications per N.E.C. Article 760. All circuits shall be marked in accordance with N.E.C. 760-23.

C. Wiring shown is diagrammatic to define system and is not intended to show every wire. Review drawings prior to bidding and inform Contractor of any additional wiring necessary for installation of systems. Wiring shall comply with pathway survivability requirements defined in NFPA 72. Include cost of all wiring in bid.

D. Submit complete shop drawings of system for review including terminal to terminal connection diagrams for system components and associated equipment interfaces, conduit diagrams, complete descriptive information on each item of equipment including UL listing for all system components, and any other information required by Architect to describe system. Identify color code and terminal numbers on shop drawings.

E. After completion of work, submit one set of record mylar sepias with items for Owner described above. Typical type drawings will not be accepted.

F. Manufacturer's trained technical representative shall supervise installation, connections and tests. The authority having jurisdiction shall be notified prior to installation or alteration of equipment or wiring. Before acceptance, manufacturer's representative will test and certify in writing that system is installed and functioning properly as intended by drawings and specifications. Test includes operation of all devices in entire system.

G. Guarantee entire system in writing for one year from date of acceptance by Owner. Guarantee will cover completely all components, equipment, wiring, etc. Repair any defects found in the system within the guarantee period without cost to owner.

H. Submit with bid a guaranteed price for complete maintenance and service of system for one year beginning at expiration of guarantee period. Price shall be guaranteed for acceptance by Owner until date of substantial completion of system.

1.3 SYSTEM OPERATION

A. Actuation of any alarm initiating device shall cause all audible alarm signals to sound, all visual indicating appliances to flash, activate an alarm LED and local tone-alert at control panel/annunciator, cause an LCD read-out of point in alarm including type of alarm (smoke detector, manual station, etc.), provide a signal to the mechanical controls to shut down or re-route air handling systems according to established plans. This shall include a suitable addressable relay at each air handling unit to shut down all air handlers in a given zone when system goes into alarm.

B. The general alarm devices may be silenced by authorized personnel only, by entering a locked cabinet and operating the proper silencing switch. A subsequent zone alarm shall reactivate the signals. Operation of the silencing switch shall be indicated by a trouble light and audible signal.

C. Operation of any sprinkler monitoring switch, power failure, opens, grounds, or any disarrangement of the system wiring or components shall be indicated by a visual and audible trouble signal. The audible trouble signal may be silenced; however, the trouble LED shall remain lit until the system has been returned to normal operating condition.

D. Analog Smoke Sensor Operation
1. The smoke sensor shall be a smoke density measuring device having no self contained alarm set-point. The alarm decision for each sensor shall be determined by the control panel. The control panel shall determine the condition of each sensor by comparing the sensor value to stored values.
2. The control panel shall maintain a moving average of the sensors smoke chamber value. Systems that do not automatically maintain a constant smoke obscuration sensitivity for each sensor by compensating for environmental factors and are deemed unacceptable.
3. The system shall automatically indicate when an individual sensor needs cleaning. When a sensor’s average value reaches a predetermined value, a “Dirty Sensor” trouble condition shall be audibly and visually indicated at the control panel for the individual sensor. Additionally, the LED on the sensor base shall glow steady giving a visible indication at the sensor location.
4. If a “Dirty Sensor” is left unattended, and its average value increases to a second predetermined value, an “Excessively Dirty Sensor” trouble condition shall be indicated at the control panel for the individual sensor.

5. The control panel shall automatically perform a daily self-test on each sensor. Checking the electronics in the sensor's base ensures the accuracy of the values being transmitted to the control panel. A sensor which fails the self-test will cause a "Self Test Abnormal" trouble condition at the control panel. A sensor self-test which must be manually initiated by the operator shall not be acceptable.

1.4 SYSTEM FEATURES

A. The fire alarm system shall include the following features as a minimum:
1. Supervision of all field wiring.
2. Microprocessor based solid state modular construction.
3. Ground fault detection and ground fault isolating & supervising circuitry.
4. 80 character LCD display to indicate alarms, supervisory service conditions and troubles.
5. Simultaneous test of all LED's and LCD's from a central point.
6. "Dead Front" design control panel/annunciator with field programmable LED alarm, status and trouble indicators, and all control switches located behind a locked tempered glass door.
7. Fully automatic battery charger and lead alkaline batteries. Batteries shall have capacity to maintain system operation for 24 hours in normal supervisory mode and shall have sufficient capacity remaining to operate in alarm mode for 15 minutes at conclusion of supervisory period. Batteries shall be supervised for connection to the system and for low voltage threshold. Ammeter and voltmeter shall be provided to indicate battery voltage and charging current.
8. Two (2) sets of 2 amp form C auxiliary alarm contacts fused with feedback.
9. One (1) set of 2 amp form C auxiliary trouble contacts.
10. Standard with 127 addressable points (expandable to 508 points) and four input/output (I/0) circuits (expandable to 20 circuits).
11. Basic four (4) amp power supply (expandable as required).
12. 600 event historical logging.
13. System shall be field programmable for offsite monitoring by remote station reverse polarity, local energy master box or shunt master box types.
14. System shall be field programmable for signal circuit type of operation; march time code, temporal code, selective code, zone code, general alarm, time limit cutout and alarm silence inhibit.
15. System shall be field programmable for waterflow/sprinkler supervisory operation on distinct zones as required.
16. Transient suppression protection shall be provided on the system power supply and on the municipal protection circuit to comply with UL 864 requirements. Additionally, surge suppression shall be provided within the control panel on all circuits that extend outside the building (including to roof-mounted HVAC units).
17. Supervised remote annunciator connection circuit.
18. System shall incorporate an alarm/trouble walk test.
19. Resident non-volatile programmable operating system memory for all operating requirements.

PART 2 - PRODUCTS

2.1 FIRE ALARM CONTROL PANELS/ANNUNCIATORS

A. Furnish and install Simplex type 4020-9101 fire alarm control panel(s) with options and accessories as required.

2.2 MANUAL ALARM STATIONS

A. Manual alarm stations shall be Simplex addressable type 4099-9002 break glass (double-action). The station body shall be so constructed that chips and scratches will not expose metal. All stations shall be master keyed with the control equipment. When actuated, the "Pull Lever" shall remain at right angle to the station body until reset.

B. Boxes:
1. Recessed, two-gang outlet boxes with Simplex type 2099-9813 red, semi-flush trim plates shall be used where possible.
2. Where surface-mount outlet boxes are required, boxes shall be red, cast aluminum Simplex type 2975-9022.

2.3 PHOTOELECTRIC SMOKE SENSOR

A. The smoke sensors shall be of the photoelectric addressable Simplex type 4098-9714 and shall communicate actual smoke chamber values to the system control panel. The smoke sensors shall operate on the light scatter principle. For maximum maintenance free service and low power requirement, light source for detection chamber and visual alarm indication shall be solid state photodiode.

B. Each sensor base shall be visually and electrically supervised.

C. The sensors shall be listed to UL Standard 268 and shall be documented compatible with the control equipment to which they are connected. The sensors shall be listed for both ceiling and wall mount applications.

D. Each sensor base shall contain integral addressable electronics and an LED that will flash each time it is scanned by the control panel (once every 4 seconds). The control panel shall be responsible for drift compensation. When the control panel determines that a sensor is in an alarm or a trouble condition, the control panel shall command the LED on that sensor's base to turn on steady indicating the abnormal condition. Sensors which do not provide a visible indication of an abnormal condition at the sensor location shall not be acceptable. Sensor bases shall be compatible with detachable photoelectric, ionization and heat sensors so that these various sensor types can be easily interchanged to meet specific location requirements. Sensor base shall be addressable type as required.

E. Where required, sensor bases shall be provided with a relay driver output and supervised relay, which are to be controlled either automatically or manually from the control panel.

F. Each sensor base shall be scanned by the control panel for its type identification to prevent inadvertent substitution of the wrong sensor type. The control panel shall operate with the installed device but shall initiate a "Wrong Device" trouble condition until the proper type is installed or the programmed sensor type is changed.

G. Each sensor shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.

H. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.

I. Cover all smoke detection devices with plastic bags immediately after installation to maintain cleanliness, if field conditions so require.

J. Provide a U.L. listed sensor guard for sensors in areas subject to tampering. The guard shall be suitable for ceiling or sidewall mounting and hinged for easy access. The guard shall be securely mounted with tamper-proof screws.

2.4 PHOTOELECTRIC DUCT DETECTOR

A. The detector shall be an addressable, non-polarized 24VDC, Simplex type 4098-9755, which is compatible with the Fire Alarm Control Panel and obtains its operating power from the supervisory current in the fire alarm detection loop. It shall be of the same analog type as the ceiling smoke detectors. Detectors shall be of the solid state photoelectric type and shall operate on the light scattering, photodiode principle. To minimize nuisance alarms, detectors shall have an insect screen and be designed to ignore invisible airborne particles or smoke densities that are below the factory set alarm point. No radioactive material shall be used.

B. The detector head shall be directly interchangeable with an ionization detector type. The 24VDC detector may be reset by actuating the control panel reset switch.

C. Detector construction shall have a mounting base with a twist-lock detecting head that is lockable. The locking feature must be field removable when not required. Contract between the base and head shall be of the bifurcated type utilizing spring type, self-wiping contacts. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel.

D. Sampling tubes sized to match duct size as recommended by equipment manufacturer shall be provided with duct detectors as required.

E. Detector design shall provide compatibility with other normally open fire alarm detection loop devices (heat detectors, pull stations, etc.). It shall be possible to alarm the duct housing by using a test switch. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housings front cover.

F. To minimize false alarms, voltage and RF transient suppression techniques shall be employed as-well-as smoke signal verification circuit and an insect screen.

G. Separate auxiliary SPDT relays for fan shutdown shall be provided with each duct detector for fan shutdown, smoke evacuation or other purposes as indicated on plans.

H. Remote key operated test stations with LED alarm indicators shall be installed in an accessible, inconspicuous location for each duct detector.

I. Duct detectors shall be installed for the equipment as indicated on plans as follows (locations shown on plans are diagrammatical only):
   1. A minimum of six duct widths downstream from bends or inlets to avoid air turbulence.
   2. On the downstream side of filters to detect fires in the filters.
   3. In return ducts, ahead of mixing areas.
   4. Upstream of air humidifier and cooling coil.
   5. With accessibility for test and service.

J. The following duct detector locations shall be avoided:
1. Where dampers closed for comfort control would interfere with airflow.
2. Next to outside air inlets (unless the intent is to monitor smoke entry from that area).
3. In return air damper branch ducts and mixing areas where airflow may be restricted.

K. Where duct detectors are installed in exterior or wet locations, weatherproof duct housing enclosures shall be provided to protect the detectors. Enclosures shall be located to be in shaded areas rather than direct sunlight. Entire installation shall be as directed by the equipment manufacturer.

2.5 HEAT SENSORS

A. Heat sensors shall be U.L. listed, addressable Simplex type 4098-9733. They shall provide rate-of-rise temperature sensing, fixed temperature sensing (135 degrees F) and utility temperature sensing (32 degrees F to 155 degrees F range).

B. Each sensor base shall be visually and electrically supervised.

C. The sensors shall be listed to UL Standard 268 and shall be documented compatible with the control equipment to which they are connected. The sensors shall be listed for both ceiling and wall mount applications.

D. Each sensor base shall contain integral addressable electronics and an LED that will flash each time it is scanned by the control panel (once every 4 seconds). The control panel shall be responsible for drift compensation. When the control panel determines that a sensor is in an alarm or a trouble condition, the control panel shall command the LED on that sensor's base to turn on steady indicating the abnormal condition. Sensors which do not provide a visible indication of an abnormal condition at the sensor location shall not be acceptable. Sensor bases shall be compatible with detachable photoelectric, ionization and heat sensors so that these various sensor types can be easily interchanged to meet specific location requirements. Sensor base shall be addressable type as required.

E. Where required, sensor bases shall be provided with a relay driver output and supervised relay, which are to be controlled either automatically or manually from the control panel.

F. Each sensor base shall be scanned by the control panel for its type identification to prevent inadvertent substitution of the wrong sensor type. The control panel shall operate with the installed device but shall initiate a "Wrong Device" trouble condition until the proper type is installed or the programmed sensor type is changed.

G. Each sensor shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.

H. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.

I. Heat sensor shall be automatically restorable.

2.6 MAGNETIC DOOR HOLDERS

A. Provide Simplex type 2088 series magnetic door holders as required where shown on plans.

2.7 ALARM SIGNALS (AUDIBLE)

A. Horns:
1. Alarm horns shall be Simplex type 4901-9820. The horns shall be polarized and shall be operated by 24 VDC. Each horn assembly shall include separate wire leads for in/out wiring for each leg of the associated signal circuit. T-tapping of signal device conductors to signal circuit conductors shall NOT be accepted. Where horns are shown as a combination audio-visual assembly, they shall be mounted as a combination unit in a single back box (4903 series) . Horns shall be capable of producing 95 dB.

B. Electronic Chimes:
1. Electronic chimes shall be Simplex type 2902 series. The chime shall be polarized and shall be operated by 24 VDC with a minimum of 82 dB at 10 ft. Adaptors shall allow surface, semi-flush, weather resistance, or audio/visual mounting as shown on the plans.
2. Chimes shall have field adjustable volume control. They shall be provided with four (4) connections to insure properly supervised in/out system connection. Chime shall be U.L. listed for its intended purpose. Where chimes are shown as a combination audible-visual assembly, they shall be mounted as a combination unit with an adapter in a single back box.

C. Devices required to be surface mounted shall be furnished with Simplex type 2975-9145 surface mounting box and 4905-9903 adaptor plate.

D. Devices installed in areas subject to mechanical damage (ie. gymnasiums) shall be furnished with suitable wire guards as indicated on plans.

2.8 ALARM SIGNALS (VISUALS)

A. Visual Flashing Lamps (Xenon Strobe):
1. Furnish and install per plans and specs Simplex type 4904 series visible appliance for fire alarm system notification. The appliance shall be 1HZ synchronized (15cd, 30cd, 110cd) with polar distribution or 75 cd illumination as required by the Americans with Disabilities Act (ADA). The appliance shall be U.L. listed to Standard 1971 and have a circumpolar light output allowing mounting in either vertical or horizontal positions or on the ceiling.
2. The light unit shall be of ABS polycarbonate and the lens of high grade, optical quality LEXAN. For optimized light distribution, the xenon flash tube shall be installed perpendicular to the appliance's back plane. A special compound reflector shall be utilized to maximize and best distribute the light pattern in key axis directions.
3. The effect of the illuminated visible appliance shall be observable in a circumpolar pattern. The visible appliance shall be labeled with the word "FIRE" in a contrasting color and the height of each character shall be a minimum of 5/8 inches. In its quiescent state, the word "FIRE" shall be visible.
4. Mounting heights of visual appliances shall in all respects comply with the Americans with Disabilities Act.
5. Visual indicating appliances shall be Simplex type 4904 series and comprised of a Xenon flashtube and be entirely solid state. These devices shall be U.L. listed and be capable of either ceiling or wall mounting. The LEXAN lens shall be pyramidal in shape to allow better visibility. Visual units shall be of the stand alone type.

2.9 REMOTE ANNUNCIATOR

A. Where shown on the plans, provide and install an LCD annunciator. The annunciator(s) shall have a stainless steel finish and shall provide the same functionality as the main control panel front panel display. The annunciator shall communicate to the control panel over one twisted shielded pair of wire and operating power shall be 24VDC and be fused at the control panel. Point-wired annunciators will not be considered as equal.

B. The serial annunciator shall provide a common alarm and trouble circuit consisting of:
1. Control push-button switches – for alarm silence, trouble silence, system reset and manual evacuation duplicating the control panel switches. A key "enable" switch shall be provided to activate or deactivate the control switches.
2. Tone Alert – Duplicates the control panel tone alert during alarm and trouble conditions.
3. System trouble LED.
4. Power on LED.

C. To accommodate and facilitate job site changes the control switches shall have the capability to be programmed on site to provide for manual switch input operation other than their standard purpose.

2.10 SPRINKLER FLOW SWITCHES

A. Sprinkler flow switches and supervisory switches are provided under another section of these specifications. This contractor shall be responsible for electrical connection of these devices to the fire alarm system.

2.11 SMOKE DAMPERS

A. Smoke dampers are provided under another section. This contractor shall be responsible for supplying a source of power and connecting them to the fire alarm system to close on alarm.

2.12 SYSTEM RECORD DOCUMENT CABINET

A. Furnish and install a documentation cabinet at the system control unit or other approved location. All final record documentation shall be stored in the cabinet. Cabinet shall be labeled as "SYSTEM RECORD DOCUMENTS". Cabinet shall include a 4 gigabyte digital flash drive interface with USB connector loaded with a digital copy of all system documentation including shop drawings and product data.

2.13 OFF SITE MONITORING

A. Furnish all material and labor to accomplish and coordinate with local company or fire department as necessary for off site monitoring of the Fire Alarm System. Transmission method(s) shall be as required by applicable codes and Authority Having Jurisdiction (AHJ). Off site monitoring shall be in operation prior to final acceptance. Exact type of off site monitoring (basic reporting or advanced reporting as described below) shall be provided by the contractor per the owner's direction.

B. Furnish and install serial digital alarm communicating transmitter (DACT), capable of reporting specific alarm points to the central station. DACT shall be universal in that it can be utilized to either provide basic reporting (alarm, trouble, supervisory conditions) or more advanced reporting (point-to-point reporting of specific alarm conditions) DACT shall be mounted integral to or beside fire alarm control panel.

2.14 FIRE ALARM CABLING

1. All fire alarm cabling shall:
   a. Have red outer insulation/jacket with ripcord.
   b. Be listed and labeled for the intended use in Fire Alarm systems.
   c. Where Level 2 or Level 3 pathway survivability is required by NFPA 72, cabling shall be 2-hour fire rated circuit integrity (CI) type.
   d. Be manufactured by West Penn, Allied, Belden or Superior Essex.

2.15 FIRE ALARM SYSTEM MANUFACTURER

A. All equipment shall be listed by UL. All panels and peripheral devices shall be the standard equipment of a single manufacturer and shall display the manufacturer's name on each component. Manufacturer's numbers specified in this section are those of Simplex Time Recorder Company to denote type, quality, material and desired operating features to be furnished.

B. Equipment shall be as manufactured by Simplex, Notifier or EST.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide and install the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations.

B. The contractor shall provide 120VAC power to all remote booster power supplies, control panels, transponder cabinets or other similar items as required. Where the project is provided with emergency power from an emergency generator, all power supplies shall be connected to an emergency source. Dedicated branch circuit(s) shall be provided to supply primary power to the fire alarm system. The associated branch circuit breakers shall be furnished with lock-on hardware and shall be identified with red marking as a fire alarm circuit. The location of the circuit disconnecting means shall be permanently identified at the fire alarm control unit.

C. All wiring shall be installed in strict compliance with all the provisions of NEC - Article 760 Parts I and III, Power-Limited Fire Protective Signaling Circuits or if required may be reclassified as non-power limited and wired in accordance with NEC-Article 760 Parts I and II.

D. All wiring shall be installed in strict compliance with pathway survivability requirements of applicable codes including NFPA 72.

E. Upon completion, the contractor shall so certify in writing to the owner and general contractor.

F. Front surface of all junction box covers in concealed areas (such as above lay-in ceilings) or within mechanical/electrical rooms (and other similar areas where appearance of boxes is not an issue) shall be sprayed red and labeled "Fire Alarm" or “F/A”. Covers in exposed areas shall be labeled “F/A” on interior of front cover. Wiring color code shall be maintained throughout the installation.

G. All fire alarm wiring shall be installed in conduit. Conduit shall be sized per manufacturer’s recommendations, but in no case shall conduit be smaller than 3/4”.

H. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate subcontractors.

I. All raceways shall be concealed unless specifically shown or approved otherwise.

J. The contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation.

K. Install System Record Document cabinet adjacent to control panel unless alternate location is approved.

L. The manufacturer's authorized representative shall provide on-site supervision of installation and shall provide all system setup and programming services.

M. The manufacturer’s authorized representative shall have as a minimum, a NICET LEVEL III certification. The fire alarm contractor shall have a technician with a minimum Nicet Level III certification working in a position of responsibility. All technicians working for the certified contractor shall have a minimum Nicet Level II certification. Any fire alarm contractor wishing to bid on the fire alarm work shall show evidence of certifications at the pre-bid conference.

N. The fire alarm contractor shall be licensed as a certified fire alarm contractor by the state in which the work is to be performed in compliance with all requirements of state fire marshall or other AHJ’s as applicable.

O. The drawing/specifications included herein are to indicate contract intent only. The Fire Alarm contractor shall provide final design documents to include plans specifying exact device types/locations, circuitry, battery calculations, circuit/voltage drop calculations, etc. in accordance with all applicable code requirements. These final design documents shall be prepared under the supervision of an engineer licensed in the state where the work is to be performed, engaged/employed by the Fire Alarm contractor, and must bear the engineer’s licensure seal with signature and date.

3.2 TESTING

A. The completed fire alarm system shall be fully tested in accordance with NFPA-72H by the contractor in the presence of the owner's representative and the Local Fire Marshal. Upon completion of a successful test, the contractor shall so certify in writing to the owner and general contractor, and shall submit final testing results with O&M documentation..

B. The contractor shall test and demonstrate proper operation of all smoke detection equipment and associated HVAC controls to the satisfaction of the authority-having-jurisdiction and fire marshal.

3.3 WARRANTY

A. The contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the completed and certified test or from the date of first beneficial use.

B. The equipment manufacturer shall make available to the owner a maintenance contract proposal to provide a minimum of two (2) inspections and tests per year in compliance with NFPA-72H

guidelines.

3.4 CERTIFICATION & ACCEPTANCE

A. A factory trained representative of the manufacturer shall supervise final testing of the system in accordance with N.F.P.A. Standard 72H-1984 in the presence of a representative of the authority having jurisdiction. Manufacturer's representative shall be NICET trained and shall have a level III NICET certificate. It shall be subject to the approval and acceptance of the responsible engineer. On completion of the acceptance tests, the Owner or his representative shall be instructed in the operation and testing of the system.

B. The fire alarm system shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of acceptance or beneficial occupancy whichever is earlier. Any equipment shown to be defective in workmanship or material shall be repaired, replaced, or adjusted free of charge.

C. The equipment manufacturer shall be represented by a local service organization, and the name of this organization shall be furnished to the Architect and Owner. The service organization shall be located within 50 miles of the job site. The service organization shall furnish, gratis to the Owner, a one year maintenance warranty contract, effective from the date of final acceptance.

END OF SECTION 28 31 00

SECTION 28 78 00

EMERGENCY RESPONDER RADIO COVERAGE SYSTEM

PART 1 - GENERAL

1.1 INITIAL RADIO SIGNAL SURVEY (INCLUDE IN BASE BID)

A. Include all costs in base bid for the Fire Alarm Contractor to conduct a radio signal survey immediately after building structure is complete, and prior to ceiling installation to determine signal coverage and strength of the municipality's emergency responder radio (public safety) system inside the project facility.

B. Conduct a survey using a RF Spectrum Analyzer, a calibrated, system-compatible radio or another suitable instrument with traceable certificate of calibration to analyze the RF signal strength. Both inbound and outbound signal strength shall be determined, measured, calculated and documented as required by code and AHJ. Survey shall be performed by FCC GROL certified technicians. Survey shall include measurements at a minimum of 20 readings per floor or 1,600SF if the floor area exceeds 32,000SF and in all critical areas or as otherwise directed by AHJ.

C. Survey report and drawing indicating measurements at each frequency band of interest shall be submitted to the AHJ for review. The report shall clearly indicate all areas that do not meet a minimum of -95dBm nominal uplink or downlink signal at 100% or a Delivered Audio Quality (DAQ) of 3.0.

D. If measured levels determined to be insufficient, a complete Emergency Responder Radio Coverage (ERRC) system shall be provided in accordance with these specifications below. Cost for the system and installation will be paid through allowance.

E. Contractor shall be responsible for scheduling survey so that all of the following is completed prior to the installation of ceilings:
1. Conduct initial survey
2. Submit survey results and report to the AHJ for review and determination of system requirements
3. Provide system design and submit shop drawings to architect and AHJ for review

1.2 SCOPE (SEE ALLOWANCES)

A. The contractor shall design, furnish, install, and warranty a complete Emergency Responder Radio Coverage (ERRC) system. The installed system shall include all hardware, bi-directional amplifiers, band-pass filters, surge suppressors, lightning protection, UPS, transmission lines, power cabling, antennas, and other components necessary for a complete operational system as specified and as acceptable to the local authorities having jurisdiction.

B. Equipment manufacturer name and model numbers specified are provided to establish quality of equipment and system operational features. Any proposed substitution of equipment from that specified must be approved by the Architect within ten (10) days prior to bid date.

C. The entire system shall be guaranteed for a period of one (1) year from the date of final

acceptance of the installation and the Contractor shall repair or replace defective equipment, during this period, at no cost to the owner.

D. Entire system shall be verified and approved by local AHJ to comply with all emergency responder radio network requirements including signal strength and frequency range.

1.3 DEFINITIONS

A. BDA: Bi-Directional Amplifier is a two-way signal booster that is used to amplify band-selective or multi-band RF signals in the uplink, to the base station and in the downlink from the base station to subscriber devices for enhanced signals and improved coverage.

B. DAS: Distributed Antenna System is a network of separate antenna nodes connected to a common transport medium.

C. ERRC: Emergency Responder Radio Coverage System is a complete in-building radio communication system that brings wireless signals into a structure from outside, amplifies those signals with a signal booster (BDA), and then evenly distributes the amplified signals throughout a structure via a Distributed Antenna System (DAS). The system also amplifies signals originating inside the building and transmits them outside.

D. Donor Antenna: Antenna that receives and transmits signal to radio system outside of facility.

1.4 STANDARDS

A. The system shall comply with all requirements of the latest edition of each of the following codes and standards. The latest edition of these codes and standards form a part of this specification:
1. U.L. Standard 2524.
2. International Fire Code Section 510
3. NFPA 1221
4. NFPA 72
5. All requirements of local Fire Department, Building Department and all other authorities having jurisdiction (AHJ)

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For headend and distribution system. Include plans, elevations, sections, details and attachments to other work.
1. Show fabrication and installation details for equipment.
2. Functional Block Diagram: Show single-line interconnections between components for headend and distribution system. Show cable types and sizes.
3. Dimensioned Plan and Elevations of Headend Equipment: Show access and workspace requirements.
4. Wiring Diagrams: For power, signal, and control wiring and transmission cable, include cross connects, taps, and other connections cords.

C. Design Calculations: Calculate signal attenuation budget and show calculated line and equipment losses for the system based on the functional block diagram, to show that proposed

system layout can be expected to perform up to specification. Calculate signal strength from sources to endpoints. Allowable losses between components and user interface shall be used to determine size and type of cable.

D. Coordination Drawings: Include dimensioned plan and elevation views of components and enclosures. Show access and workspace requirements.

E. Equipment List: Include each piece of equipment and include model number, manufacturer, serial number, location, and date of original installation. Insert testing record of each piece of adjustable equipment, listing name of person testing, date of test, and description of as-left set points.

F. Field quality-control reports.

G. Operation and Maintenance Data: For headend and distribution system to include in emergency, operation, and maintenance manuals.

H. Contract shall submit set of all drawings and product data to permitting agencies as required. These final design documents shall be prepared under the supervision of an engineer licensed in the state where the work is to be performed, engaged/employed by the system vendor, and must bear the engineer's licensure seal with signature and date.

I. Any permits necessary for the installation of the work shall be obtained prior to the commencement of the work. All permit costs and inspection fees shall be included.

PART 2 - PRODUCTS

2.1 RADIO FREQUENCY (RF) BDA-BASED SIGNAL BOOSTER SYSTEMS

A. In-building signal booster systems shall receive and re-transmit the entire uplink/downlink frequency band utilized by the regional emergency service provider(s)**.** The contractor shall confirm with the regional emergency service provider(s) as to the specific frequencies used by the various agencies. This system shall be state-of-the-art, operating bi-directionally and in full duplex. The system shall be fully compatible with and function on Locality's Public Safety Radio System.

B. BDA shall be capable of providing in building coverage for all the cellular networks as identified by the owner.

C. Signal boosters (BDA)
1. Shall have Nema Type 4 enclosure
2. Shall be UL2524 listed
3. Shall be FCC certification.
4. Provide standby battery system capable of maintaining the system operational for a minimum of 12 hours or 2 hours if supplied by emergency generator circuit. Batteries system shall be completely enclosed in Nema Type 4 enclosure.
5. Signal Boosters shall have oscillation suppression circuitry to protect the public safety radio system in case of system malfunction or other causes. The oscillation suppression circuit shall not disable the system operation. Systems that automatically disable the signal booster upon oscillation detection shall not be allowed

6. Signal Boosters shall have uplink noise suppression function to eliminate uplink noise while in standby (i.e. no radio transmission from within a building).
7. Include relays as required for monitoring system with fire alarm system.

D. DAS Antennas shall be architectural, dome or flush type where located in public areas. Stick type antennas are acceptable where located in back-of-house spaces. Finish shall be white unless directed otherwise by architect in submittal review.

E. A dedicated supervised monitoring panel shall be provided next to the fire alarm panel / annunciator or other location as designated by AHJ to annunciate the status of all signal booster locations. The monitoring panel shall provide visual and labeled indication of the following for each signal booster:
1. Normal AC power
2. Signal booster trouble
3. Antenna Failure
4. Loss of normal AC power
5. Failure of battery charger
6. Low battery capacity

F. Completed installations (including cabling) shall comply with all applicable codes and standards, including County Building and Electrical Codes, NFPA, ANSI, NEC, OSHA, EIA, IEEE, R-56, etc., as well as the FCC Rules and Regulations, as applicable. Equipment provided shall be UL listed and FCC type accepted for this specific application. Compliance to codes and standards shall extend to include proper grounding, bonding and surge.

G. All cabling shall be plenum rated.

H. All vertical riser cabling shall be 2-hour rated.

2.2 DESIGN REQUIREMENTS:

A. The system shall provide digital signal strength coverage over 95% area on each floor/level of the equipped building, or in specific areas defined by Locality in a Scope of Work document for a particular building or site. Critical areas shall have 99% floor area coverage.

B. Systems shall provide a minimum digital and analog overage of Circuit Merit (CM) 3 and Delivered Audio Quality (DAQ) 3.0, with a reliability factor of 95%.

C. Antenna isolation shall be maintained between the donor antenna and all inside antennas (D.A.S.) to a minimum of 20dB under all operating conditions

D. A Coverage Acceptance Test shall be executed prior to final acceptance of an installed system. Coverage acceptance testing shall be based on audio quality performance in evenly spaced test grids in the defined service areas. A minimum of 20 tests will be taken per floor/level. Total number of test grids will be determined by the Owner, based on the size of the space per floor/level.

E. Design and appearance will be of “finished” construction, i.e. shall be concealed and/or unobtrusive in finished areas. DAS antennas shall be located in back-of-house areas where possible. If required to be located in visible public aeras, antennas shall be architectural, low-

profile type and located in corridors where possible. Unless indicated otherwise, wire mold and surface conduit installations will not be acceptable unless approved in writing by the Architect in advance.

2.3 MANUFACTURER

A. Equipment shall be as manufactured by Simplex, Notifier or EST or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wiring shall be in strict accordance with the National Electrical Code and all state and local regulations. Wiring shall be installed in accordance with manufacturer's wiring diagrams and shall test free from ground, opens and short circuits.

B. All connections shall be made under the direct supervision of a qualified technician.

C. Contractor shall provide dedicated power circuits as required for system operation. Where an emergency distribution system is provided, radio coverage system power shall be connected to the emergency branch.

D. All vertical riser cabling shall be installed in conduit within a 2-hour fire rated enclosure.

E. All copper circuits routed between or outside of buildings shall be provided with a surge protection device at each end.

F. Securely mount donor antenna on roof and aim towards direction of public safety city repeater antenna. All mounting and penetrations shall be coordinated with roofing contractor.

G. Contractor shall provide all devices and cabling as required to monitor system with building Fire Alarm System in accordance with all applicable code requirements.

H. Refer to Specification Section 27 05 00 for additional installation requirements.

I. During initial installation, each system shall be optimized to perform in accordance with the specifications set forth in the system design, manufacturer's specifications and FCC regulations. The contractor shall ensure that uplink and downlink levels are properly set and consistent with design expectations. The contractor shall further ensure that noise and spurious products are held within limits set forth in the system design, manufacturer's specifications and FCC regulations. Prior to system acceptance, for each active BDA, booster amplifier, etc., the contractor shall submit a Proof of Performance certification, that lists the design expectations, actual measurements, and if applicable, FCC specifications for the following parameters:
   1. Worst case BDA uplink input level, in dBm.
   2. Worst case BDA uplink output level, in dBm.
   3. BDA downlink input level, in dBm.
   4. BDA downlink output level, in dBm.
   5. Noise and spurious products, BDA uplink output, in dBc.
   6. Noise and spurious products, BDA downlink output, in dBc.

J. The original Proof of Performance report shall be submitted to Owner's project manager, and a copy of the Proof of Performance report shall be affixed to its associated equipment.

3.2 WARRANTY

A. The contractor shall provide a full one-year warranty to cover installation and all equipment, software, and components; the warranty shall commence upon the Owner's final acceptance of the facility. Under warranty coverage, the successful contractor shall provide same business day response time for system malfunctions.

B. The contractor shall perform optimization of each system during the initial warranty period, sixty (60) to ninety (90) days prior to warranty expiration. This optimization task is separate from the initial optimization performed during system installation. The contractor shall include pricing for annual system optimization to be included as part of post-warranty maintenance. Actual scope of work for annual optimization and maintenance will vary on a case-by-case basis, but typically will consist of the following:
1. Optimize the system to perform in accordance with the specifications set forth in the system design, manufacturer's specifications and FCC regulations.
2. Ensure that uplink and downlink levels are properly set and are consistent with design specifications.
3. Ensure that noise and spurious products are held within limits set forth in the system design, manufacturer's specifications and FCC regulations.

C. Update the Proof of Performance records for the system, listing the design expectations, actual measurements, and if applicable, FCC specifications for the following parameters:
1. Worst case BDA uplink input level, in dBm.
2. Worst case BDA uplink output level, in dBm.
3. BDA downlink input level, in dBm.
4. BDA downlink output level, in dBm.
5. Noise and spurious products, BDA uplink output, in dBc.
6. Noise and spurious products, BDA downlink output, in dBc.

D. The updated Proof of Performance report shall be submitted to the Owner, and a copy of the updated Proof of Performance report shall be affixed to its associated equipment.

E. Visually inspect outside antenna installation. Correct any issues found with the antenna mounting hardware, grounding system, or outside cabling.

F. Visually inspect inside BDA or booster amplifier equipment installation. Correct any issues found with RF cabling, electrical connection, or equipment mounting.

G. Clean equipment fans, filters and other ventilation system components.

H. Inspect and replace any defective indicator lights.

I. Test battery system performance for proper fallback to battery power and the duration of battery operation.

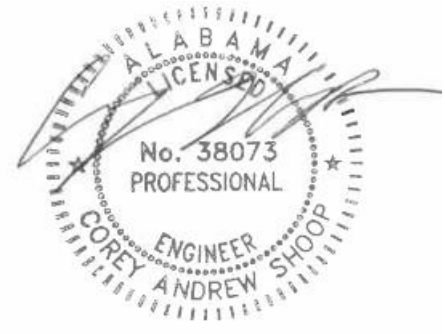
J. Test fault reporting system for proper operation and reporting of system faults.

K. Submit a written Preventive Maintenance Report to the Owner, listing the results of the optimization and preventive maintenance effort. The report shall include the Proof of Performance report for active RF components, and details of any other discrepancies found and corrective actions taken.

L. All as-built drawings shall be submitted to the Owner at completion, which shall include antenna system layout and all associated hardware, along with specification sheets. Include RF measurements taken.

END OF SECTION 28 78 00

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4/27/2026

Applicable for Sections: 02 4100, 31 1000, 31 2000, 31 2500, 32 1216, 32 1313, 32 1613, 32 1723, 33 1000, 33 3000 and 33 4001

SECTION 31 1000

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related work specified elsewhere includes Sections:
.. Section 31 2000 - “Earth Moving”
.. Section 02 4100 - “Demolition”

1.2 SUMMARY

A. This Section includes the following:

1. Protection of existing trees and landscaping to remain, if any, and boundary and property line markers, bench marks, survey control points, and existing structures and improvements which are to remain.

2. Environmental and erosion control measures, as indicated and as otherwise required by applicable codes, regulations, and authorities having jurisdiction.

3. Removal of trees and other vegetation, as indicated, and within “controlled areas.”

4. Topsoil stripping, and stockpiling, as indicated, and within “controlled areas.”

5. Removing above-grade improvements as indicated, and as required to accommodate new construction.

6. Removing below-grade improvements as indicated, and as required to accommodate new construction.

1.3 PROJECT CONDITIONS

A. Traffic: Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction, unless specifically indicated elsewhere in contract documents.

B. Protection of Existing Improvements:

1. Provide protection necessary to prevent damage to existing improvements indicated to remain in place. Clearing, demolition and any excavation within 5'-0" of existing buildings and structures to remain shall be performed by hand.

2. Protect improvements on adjoining properties and on Owner's property.

3. Protect boundary and property line markers, bench marks, and survey control points.

4. Restore damaged improvements and markers to their original condition, as acceptable to property owners.

PART 2 - PRODUCTS

A. Not applicable to this Section.

PART 3 - EXECUTION

3.1 SITE CLEARING

A. General:

1. Remove trees, shrubs, grass and other vegetation, improvements, or obstructions as required to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated.

B. Topsoil:

1. Topsoil is defined as friable clay loam surface soil found in a depth of not less than 6 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material.

2. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material.

   a. Remove heavy growths of grass from areas before stripping.

3. Stockpile topsoil in storage piles in areas as indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, as required, to prevent wind erosion, or seed and mulch if left undisturbed for a period of time greater than 14 consecutive days.

4. Legally dispose of off-site unsuitable soil, excess topsoil not to be stockpiled, and waste material debris.

5. Fill depressions caused by site clearing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

   a. Place fill material in horizontal layers not exceeding 8 inches loose depth, and thoroughly compact to a density equal to adjacent original ground, unless specific compaction is otherwise indicated in Section 31 2000 "Earth Moving", or, as directed in the geotechnical investigation.

3.2 DISPOSAL OF WASTE MATERIALS

A. Burning on Owner's Property: Burning will not be permitted on Owner's property.

B. Removal from Owner's Property: Remove waste materials, trash and debris, and legally dispose of same off site.

END OF SITE CLEARING

SECTION 31 2000

EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related work specified elsewhere includes:

.. Section 01 2200 - "Unit Prices"
.. Section 01 7800 - "Closeout Submittals"
.. Section 02 3213 – "Subsurface Investigation"
.. Section 31 1000 - "Site Clearing", "Report of Geotechnical Investigation"
.. Section 32 1313 - "Concrete Paving"
.. Section 03 3100 - "Concrete"
.. Division 26 - "Electrical"

1.2 SUMMARY

A. This Section includes unclassified excavation, grading and fill as follows:

1. Preparing of subgrade for building slabs, walks, and pavements; and additional work indicated on the Drawings and in the Project Manual.

a. Comply with recommendations in the Owner's "Report of Geotechnical Exploration", this Section, and other Division 31 Sections; Refer also to Civil and Structural Drawings for additional information and requirements.

b. Undercutting of building area as indicated in the Report of Geotechnical Investigation and in the Contract Documents.

c. Perform excavation by hand within 5'-0" of existing buildings and structures to remain. Design and provide all necessary supports, shoring, etc., as required to prevent settlement, collapse, and/or other damage to existing buildings and structures to remain.

1) DO NOT EXCAVATE BELOW THE EFFECTIVE BEARING AREA OF FOUNDATIONS OF EXISTING BUILDINGS AND STRUCTURES. In the event of conflict during construction, notify Architect prior to proceeding with work in the effected area.

d. Compaction of backfill at any basement and below grade walls shall only be by hand-directed compaction equipment. Heavy construction equipment and/or

heavy trucks shall not be allowed within 10-feet of any basement walls, and within 5-feet of foundation walls.

2. Drainage fill course (porous fill) for support of building slabs is included as part of this work; compacted in place.

3. Excavating and backfilling of trenches within building control areas and on site.

4. Stripping and stockpiling of topsoil (if any) is specified in Section 31 1000 - Site Clearing.

5. The extent of earthwork is indicated on the Drawings. This earthwork is to be included in the base bid as unclassified excavation, regardless of material encountered.

6. Removal of existing improvements may also be specified under various Division 31 Sections.

B. Excavating and Backfilling for Plumbing, HVAC, and Electrical Work: Refer to Divisions 22, 23, and 26 sections for excavation and backfill required in conjunction with underground mechanical and electrical utilities and buried mechanical and electrical appurtenances, not work of this Section.

1. However, construction materials and execution for Plumbing, HVAC, and Electrical work shall comply with requirements of this Section, and related Division 31 Sections, when the work and/or materials required are not indicated or only partially indicated in Divisions 22, 23, and 26.

C. Placement and compaction of at least 4-inches of topsoil up to finish grades is included in the work of this Section.

1. Allow for thickness of topsoil and sod.
2. Refer to Division 32 sections for topsoil composition and placement requirements.

1.3 DEFINITIONS

A. “Excavation” consists of removal of materials and existing improvements encountered to subgrade elevations indicated, and subsequent disposal of materials removed.

B. “Unauthorized” excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Owner’s Geotechnical Engineer. Unauthorized excavation, as well as remedial work directed by Owner’s Geotechnical Engineer, shall be at Contractor’s expense.

1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Owner’s Geotechnical Engineer.

2. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Owner's Geotechnical Engineer.

C. "Additional Excavation": When excavation has reached required subgrade elevations, notify Owner's Geotechnical Engineer, who will make an inspection of conditions. If Owner's Geotechnical Engineer determines that bearing materials at required subgrade elevations are unsuitable, continued excavation may be required. If additional excavation is required, replace excavated material as directed by Owner's Geotechnical Engineer.

1. The Contract Sum will be adjusted by Change Order, or as provided in General Conditions, for additional excavation, measured in place (Bank Measure), and its replacement appropriately authorized in writing prior to beginning the work, and for which the Contractor is due payment from the Owner.

D. "Subgrade": The undisturbed earth or the compacted soil layer immediately below pavement base course, select drainage fill, bottom of indicated undercut areas, or topsoil materials.

E. "Structure": Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

F. "Building Control Area" and/or "Controlled Area": Below and at least 10-feet beyond building foot print or exterior walls, and below roofs, to include covered porches and canopies, and below and at least 5-feet beyond all walks and pavements subject to bearing vehicular traffic.

G. "Mud Footings" (if any): The at least 2-inches to 4-inches of lean 2,500 psi (minimum) concrete placed in the bottom of footing and foundation trenches and excavations, which is required if permanent or structural concrete cannot be placed the same day they are excavated.

1. Unless mud footings are indicated on Structural Drawings, their depth shall be compensated for by over-excavation.

2. Mud footings (if any) shall be completely clean prior to placement of any reinforcing and/or permanent or structural concrete.

3. Refer to the Owner's "Geotechnical Investigation" Report, and Structural Drawings for additional information and requirements for other "mud footings" (or "mud mats", or "mud seals").

H. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material exceeding 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu. yd. (0.57 cu. m) for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) wide, short-tip-radius rock bucket; rated at not less than 120-hp (89-kW) flywheel power with bucket-curling force of not

less than 25,000 lbf (111 kN) and stick-crowd force of not less than 19,000 lbf; measured according to SAE J-1179.

2. Bulk Excavation: Late-model, track-mounted dozer equipped with a single tooth ripper; rated at not less than 250-hp flywheel power and developing a minimum of 45,000-lbf (200-kN) breakout force; measured according to SAE J-732.

3. Refer to "Owner's Report of Geotechnical Exploration" for additional information regarding recommendations when rock is encountered.

1.4 SUBMITTALS

A. Test Reports: Submit the following reports directly to Architect, Civil Engineer, Structural Engineer, and the Owner, directly from the testing service, with copy to Contractor:

1. Test reports on fill and borrow material.

2. Verification of suitability of each foundation, floor slab and subgrade condition and material, in accordance with specified requirements.

3. Field reports; and in-place soil density tests.

1.5 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work on site and in right-of-ways in compliance with applicable requirements of authorities having jurisdiction.

B. Testing and Inspection Service: All required soil testing and inspection services during earthwork operations shall be performed by a qualified independent geotechnical testing laboratory.

1. Refer to Section 01 0150 - "Special Conditions", for additional information and requirements.

1.6 PROJECT CONDITIONS

A. Site Information: Refer to Section 31 1000 - "Site Clearing", and Civil Drawings, for additional information and recommendations.

B. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations in the vicinity, and as may also be required for other construction work.

1. Notify the Alabama Line Location Center at 1-800-292-8525 at least 2-full working days (48 hours), excluding weekends and holidays, prior to any excavation work. This organization will contact its member utility companies to locate and mark all of their own underground facilities.

a. Notify non-member companies directly, for them to perform this service.

2. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions and record locations on as-built record drawings. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

3. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Architect and then only after acceptable temporary utility services have been provided.

   a. Provide minimum of 48-hour notice to Owner and copy Architect, and receive written notice to proceed before interrupting any utility.

4. Demolish and completely remove from the site any existing underground utilities to be removed, and all existing underground utilities in "controlled areas". Coordinate with utility companies for shutoff of services if lines are active.

C. Use of Explosives: **Use of explosives *is not* permitted.**

D. Protection of Persons and Property:

1. Barricade open excavations occurring as part of this work and post with warning lights.

2. Operate warning lights as recommended by authorities having jurisdiction.

3. Comply with requirements of current regulations of OSHA, applicable Codes, ordinances, and authorities having jurisdiction.

4. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

5. Perform excavation by hand within 5'-0" of existing buildings and structures to remain, and within dripline of large trees to remain. Protect root systems from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap. Paint root cuts of 1-inch and larger with emulsified asphalt tree paint.

   a. Do not under-mine or excavate below footings and/or foundations which are to remain.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS - DEFINITIONS

A. Satisfactory soil materials are defined as clean, non-saturated, non-organic sections of earth taken from acceptable sources, and complying with ASTM D2487 soil classification groups included in recommendations of the Owner's "Report of Geotechnical Exploration", or if not included, as directed at the time of earthwork operations and/or acceptance resulting from acceptable test results obtained on soil materials proposed by the Contractor and tested by the project Geotechnical Engineer, as required by the Bid and Contract Documents.

Liquid Limit (LL)	**Less than 50%**
Plasticity Index (PI)	**Less than 25%**
Maximum Dry Density (ASTM D-698)	**Greater than 100 pcf**
Maximum Particle Size	**3 inches or less**
Organic Matter	**Less than 5%**

B. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups other than those indicated above.

C. Drainage Fill (or "porous fill" or "drainage aggregate"): Clean, washed, evenly graded mixture of free-draining pea gravel, coarse sand, or crushed stone, with not more than 50 percent passing a No. 50 sieve and not more than 5 percent passing a No. 200 sieve, and subject to approval by the project geotechnical engineer and testing laboratory; **Minimum 4-inches compacted completed thickness.**

D. Backfill and Fill Materials (Grassed areas only; Cuts and fills outside "controlled areas", during general grading): Satisfactory soil materials from on-site excavations, free of clay, rock or gravel larger than 2-inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious material.

1. All fill soils must be compatible with existing soils, so they can bond together.

E. Topsoil: Refer to Section 31 1000 - "Site Clearing."

F. Rock Fill: Refer to Owner's "Report of Geotechnical Investigation" for recommendations regarding placement and compaction requirements.

PART 3 - EXECUTION

3.1 PROOFROLLING

A. Areas throughout significant slopes and beneath and 10'-0" beyond new building and covered areas, and beneath and 5'-0" beyond new pavement areas (back-of-curb or other paving edge termination) shall be designated as "controlled areas." Prior to placement of fill earth and

following removal of cut earth, the controlled areas shall be proofrolled. Areas to be filled shall be proofrolled prior to any fill placement; cut areas shall be proofrolled after they are brought to subgrade level. Proofrolling shall be performed with a loaded tandem axle dump truck or similar approved equipment. The proofroller shall make at least two passes over each section in perpendicular directions over the "controlled areas". If any areas fail the proofroll, repair these areas as directed by the Owner's Geotechnical Engineer.

1. Proofrolling shall be conducted in the presence of testing lab's Geotechnical Engineer.

2. Do not proofroll when the ground surface is wet or saturated with water.

3.2 EXCAVATION

A. Earth Excavation includes excavation of pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as structures, foundations, rock or unauthorized excavation.

B. Perform excavation by hand within 5'-0" of existing buildings and structures to remain.

1. Do not under-mine or excavate below footings and/or foundations which are to remain.

C. Refer to "Definitions" paragraph above for any "mud footings" required.

3.3 STABILITY OF EXCAVATIONS

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

3.4 DEWATERING

A. Prevent surface water and Geotechnical or ground water from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Contractor to provide and maintain, at their expense,

pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

3. Due to the types of soil that exist on site, seepage and/or springs may occur. If excessive seepage or springs are discovered, notify Owner's Geotechnical Engineer and Architect immediately.

3.5 STORAGE OF EXCAVATED MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill only within the limits of the area under construction. No stockpiling will be allowed in areas that are not under construction. If there is not room for stockpiling, then the contractor will be responsible for legally disposing of the material and will not get additional compensation for the replacement of that material if fill is needed. Place, grade, and shape stockpiles for proper drainage.

1. Locate and retain soil materials away from edge of excavations.

2. Dispose of excess excavated soil material by removal and legal disposal off-site.

3.6 EXCAVATION FOR STRUCTURES

A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot; plus, a sufficient distance to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection. Do not disturb bottom of excavations, intended for bearing surface.

3. The contractor shall include in the base bid the cost of the volume of undercut and removal of existing material within the building control area, building areas plus 10 feet, to an average depth of 3 feet below existing grade for a volume of 5,700 CY. If any additional undercut is required, the contractor shall be paid by unit price through an allowance according to Section 01 2100 "Allowances". The undercut will be replaced with acceptable structural fill properly compacted. All excess undercut will be disposed of off-site at the contractor's expense.

3.7 EXCAVATION FOR WALKS AND PAVEMENTS

A. Cut surface under pavements to comply with cross-sections, elevations and grades as indicated.

1. The contractor shall include in the base bid the cost of the volume of undercut and removal of existing material within the pavement control area, pavement areas plus 5 feet, to an average depth of 18 inches below existing grade, for a volume of 5,850 CY. If any additional undercut is required, the contractor shall be paid by unit price through an allowance according to Section 01 2100 “Allowances”. The undercut will be replaced with acceptable structural fill properly compacted. All excess undercut will be disposed of off-site at the contractor’s expense.

3.8 TRENCH EXCAVATION FOR PIPES AND CONDUIT

A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 6-inches to 9-inches of clearance on both sides of pipe or conduit.

B. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on minimum of 4-inches of compacted “select fill” bedding. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

C. Except as otherwise indicated, excavate for exterior water-bearing piping (water, steam, condensate, drainage, etc.) so top of piping is not less than 2'-0" below finished grade and/or paving.

D. Where rock or concrete is encountered, carry excavation 6" below required elevation and backfill with a 6" layer of dense graded crushed stone, prior to installation of pipe.

3.9 COLD WEATHER PROTECTION

A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.10 BACKFILL AND FILL

A. General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.

1. Under all areas, use satisfactory excavated or borrow material. Refer to Owner’s “Report of Geotechnical Exploration”, and this Section, for minimum testing requirements.

2. Under building slabs, use drainage fill material of compacted and finished depth indicated, or if not indicated, **at least 4-inches** compacted and completed thickness.

3. Backfill trenches with concrete where trench excavations pass within 18-inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.

   a. Concrete is specified in Division 3.

   b. Do not backfill trenches until inspections and any required testing have been made and backfilling is authorized by Architect based on test results. Use care in backfilling to avoid damage or displacement of pipe systems.

   c. Utility trenches shall be backfilled with acceptable borrow or dense graded aggregate in 6" loose lifts compacted with mechanical piston tampers to the project requirements. Open graded stone is not to be used as backfill.

B. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, etc.

2. Inspections, testing, approval, and recording locations of underground utilities have been performed and recorded.

3. Removal of concrete formwork, if any.

4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.

   a. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.

5. Removal of trash and debris from excavation.

6. Permanent or temporary horizontal bracing is in place on horizontally supported walls, where necessary.

3.11 PLACEMENT AND COMPACTION - GENERAL

A. Ground Surface Preparation:

1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break up sloped surfaces steeper than 1-vertical to 4-horizontal so that fill material will bond with existing surface.

2. Prior to placement of fill earth and following removal of cut earth, the controlled areas shall be proofrolled. Areas to be filled shall be proofrolled prior to any fill placement; cut areas shall be proofrolled after they are brought to subgrade level. Proofrolling shall be performed with a loaded tandem axle dump truck or similar approved

equipment. The proofroller shall make at least two passes over each section in perpendicular directions over the "controlled areas". If any areas fail the proofroll, repair these areas as directed by the Owner's Geotechnical Engineer.

a. Proofrolling shall be conducted in the presence of testing lab's Geotechnical Engineer.

b. Do not proofroll when the ground surface is wet or saturated with water.

B. Place backfill and fill materials in layers not more than 8-inches in loose depth for material compacted by heavy compaction equipment, and not more than 4-inches in loose depth for material compacted by hand-operated tampers.

C. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

D. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

E. General Fill Embankment Construction

1. Embankment construction shall commence at the toe of the proposed slope and continue upwards as additional fill is placed. The engineered fill placed shall be benched into the natural slopes.

2. The embankment is to be overfilled and then cut back to the required geometry to remove the uncompacted material that is usually present on the face of fill slopes.

3. The face of slopes shall be promptly vegetated according to the Erosion Control Plan, and the CBMPP to prevent erosion after construction. Prior to vegetation, 4" minimum topsoil or as directed by Division 32 sections, is to be placed and tracked in by a dozer moving up and down the slope to create horizontal track lines.

F. Rock Fill:

1. Rock Fill is not to be used unless acceptable to the Owner's Geotechnical Engineer. Break larger particles down to 3" or less and treat as soil fill.

G. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Owner's Geotechnical Engineer if soil density tests indicate inadequate compaction.

1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density, in accordance with ASTM D 698 A:

a. Under structures, building foundations and slabs, and 10' beyond those perimeters, compact full depth of fill placement and scarify, moisture condition and re-compact in accordance with the recommendations made in the Owner's "Report of Geotechnical Exploration".

1) Cut areas shall be proof rolled prior to and during scarification efforts and observed by the Owner's Geotechnical Engineer.

b. Under steps, covered areas, sidewalks, mechanical/utility and in all "controlled areas", compact in accordance with the recommendations made in the Owner's "Report of Geotechnical Investigation".

c. Under pavements and at least 5-feet beyond (measured from back-of-curb or edge of paving, where occurs), remove loose soils as described in this and replace with suitable material that is compacted to 98% standard proctor.

d. Under lawn or unpaved areas beyond "controlled areas", compact each layer of backfill or fill material in accordance with the recommendations made in the Owner's "Report of Geotechnical Investigation".

e. On-site Borrow (where allowed): In accordance with the recommendations made in the Owner's "Report of Geotechnical Investigation".

f. Select and/or Structural Fill: In accordance with the recommendations made in the Owner's "Report of Geotechnical Investigation".

g. Porous Fill (drainage course): In accordance with the recommendations made in the Owner's "Report of Geotechnical Investigation".

2. Moisture Control:

a. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.

b. Remove and replace, or scarify and moisture condition, soil material that is too wet to permit compaction to specified density.

c. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist moisture conditioning by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

d. At the time of densification, the moisture content of "engineered fill", "structural fill", and "select fill" should be within -3% to +3% of the materials' ASTM D-698 optimum moisture content.

e. Structural fill areas exposed to excessive wetting, drying or otherwise disturbed by the construction following acceptance for moisture and density should be retested followed by the correction of deficient areas just prior to the installation of additional fill or structures.

f. In no instance should placement of structural fill or ground supported structures be permitted if the ground surface soils contain a moisture content in excess of 2% of the material's optimum moisture content.

g. In no case shall porous drainage backfill (except as specifically indicated at foundation drains only) or masonry sand material be used adjacent to foundations. Care shall be taken to prevent masonry brick/block debris from falling or being pushed into foundation excavations.

3.12 GRADING

A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as follows:

1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10-foot above-or-below required subgrade elevations. Refer to Division 32 sections for topsoil requirements.

2. Walks: Shape surface of areas under walks to line, grade, and cross-section, with finish surface not more than 0.10-foot above-or-below required subgrade elevation.

3. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 1/2-inch above or below required subgrade elevation.

4. Connection of Existing and New Work: Provide flush transition, unless specifically indicated otherwise.

C. Grading Surface of Fill under Building Slabs and "Building Control Areas": Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2-inch when tested with a 10-foot straightedge.

D. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

3.13 BUILDING SLAB DRAINAGE COURSE

A. General: Drainage course consists of placement of drainage fill material, in layers of indicated thickness, over subgrade surface to support concrete building slabs, sidewalks, pads, and below canopies and covered porches, and elsewhere as indicated.

1. Minimum Completed Thickness: 4-inches.

B. Placing: Place drainage fill material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.

1. When a compacted drainage course is indicated to be 6-inches thick or less, place material in a single layer. When indicated to be more than 6-inches thick, place material in equal layers, except no single layer more than 6-inches or less than 3-inches in thickness when compacted.

3.14 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction:

1. Allow testing service to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.

2. Perform field density tests in accordance with ASTM D 698 (sand cone method), or acceptable ASTM methods or nuclear testing method, as applicable.

3. New Footing Subgrade: All foundation excavations shall be observed by the Project Geotechnical Engineer or his representative to verify required design bearing capacities of the bearing soils.

4. New Paved Areas, New Building Slab and “Building Control Areas” Subgrade: Perform at least one field density test of subgrade for every 5,000-square feet of fill area for each foot of vertical thickness of fill placed in “controlled areas”, with a minimum of one (1) test per lift.

5. Foundation Wall Backfill: Perform at least 2-field density tests at locations and elevations as directed.

6. Trenches: Perform at least one field density test for every 50-linear feet for each 8 inches of vertical thickness of fill placed in utility or similar trenches, which extend through the “controlled areas”.

   a. Retaining walls, if any, same as for “Trenches”, as indicated above.

7. A laboratory soil particle size, Atterberg limit, and Proctor moisture density relationship test shall be performed on each different type of fill soil used in the “controlled areas”.

8. Based on the Project Geotechnical Engineer’s testing reports, inspections, and recommendations, subgrade or fills that are below specified density, additional

earthwork, compaction, and/or other operations, and re-testing, shall be performed until specified density is obtained.

3.15 EROSION CONTROL

A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction.

3.16 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

C. Repair edges of existing pavements, sidewalks, etc., and other existing and/or new improvements flush with and to match existing materials and thicknesses, subject to acceptance by Owner and Architect.

D. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

E. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.17 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Removal from Owner’s Property:

1. Remove excess and waste materials, including unacceptable excavated material, trash, debris, and waste materials, and legally dispose of off Owner’s property.

END OF EARTHWORK

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SECTION 31 2500

EROSION AND SEDIMENTATION CONTROL

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Temporary and permanent erosion control systems.

B. Slope Protection Systems.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary and Division 1 Specification Sections, apply to this Section.

1. Section 31 1000 - Site Clearing
2. Section 31 2000 – Earth Moving
3. The Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas, March 2022 edition or most recent edition.
4. Erosion and Sediment Control Plan

1.3 ENVIRONMENTAL REQUIREMENTS

A. The Contractor shall protect adjacent properties and water resources from erosion and sediment damage throughout the life of the contract.

1. The Contractor shall be responsible for the removal of sediments and debris escaping the project site, the remediation and/or repair of any damage that may occur as a result to adjoining and/or downstream affected properties or offsite structures and any fines or penalties levied against the project by regulatory agencies due to deficiencies of control measures.

B. Other than the land clearing activities required to install the appropriate erosion and sediment control measure in accordance with the erosion and sediment control plans, any down slope erosion and sediment control measures, on-site stream channel protection and upslope diversion of drainage required by site conditions, shall be in place and functional before any clearing or earth moving operations begin and shall be constructed and maintained throughout the construction period.

1. Temporary measures may be removed at the beginning of the workday but shall be replaced at the end of the workday.

C. The angle for graded slopes and fills shall be no greater than the angle which can be retained by vegetative cover or other adequate erosion control devices or structures. Any slope or fill which has been graded shall, within thirteen (13) days of the completion of such grading or the

completion of any phase of grading, be planted or otherwise be provided with ground cover, materials, devices, or structures sufficient to retain erosion. The devices, structures, and measures shall remain in place until the graded slope or fill is stabilized.

D. All hazardous substances used for this project shall be stored in accordance with current Spill Prevention Control and Countermeasures (SPCC) regulations.

1. Store substances away from storm drains, ditches, and gutters in water-tight containers.

2. Dispose of substances in accordance with ADEM regulations.

3. Provide adequate trash containers on-site for the disposal of material waste.

4. Prevent trash and debris from entering storm drainage system.

E. All construction materials shall be properly stored, not exposed to rain, and stockpiled. All containers shall be stored closed or under cover. All excess or waste material shall be disposed of properly.

1. Provide a construction waste dumpster or trailer on-site for disposal of construction waste.

2. Dispose of trash and waste to an acceptable offsite facility every week at a minimum.

3. Prevent trash and debris from entering storm drainage system.

F. There shall be no distinctly visible floating scum, oil, or other matter contained in the storm water discharge to a receiving water, must not cause an unnatural color (except dyes or other substances discharged for the purpose of environmental studies and which do not have a harmful effect on the receiving water) or odor in the receiving waters. The storm water discharge to receiving water must result in no material in concentration sufficient to be hazardous or otherwise detrimental to humans, livestock, wildlife, plant life, or fish and aquatic life in the receiving water.

1. Ensure all materials are handled appropriately.

2. No pollutants are allowed to be disposed of on-site or allowed to enter the storm drainage system.

G. Upon completion of the land disturbing activity and stable vegetation or other permanent controls have been established on all remaining exposed soil, the Contractor shall notify the Owner of this and request a final inspection.

1. The Owner, or his authorized agent, will inspect the site within 5 working days after receipt of notice.

H. The Contractor shall prevent the tracking of mud and debris onto paved roadways from construction areas.

1. Provide a construction exit pad in accordance with the erosion and sediment control plans and in accordance with the approved installation procedures, and maintain it on a daily basis.

    a. Provide a spray hose for the washing of tires and equipment

    b. Rework or supplement the construction exit pad stone as required to ensure its continued effectiveness throughout the duration of the construction period.

2. Remove any sediments tracked offsite or deposited on the adjacent roadways.

    a. Utilize a mechanically operated street sweeper to remove any mud and sediment deposited on the adjacent roadways.

I. The Contractor shall be responsible for keeping dust to a minimum through the use of water trucks or other dust controlling methods throughout the construction duration.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Quick growing grasses for temporary seeding (see seed mixes contained in CBMPP and in Plans).

B. Fencing for siltation control as specified on the plans.

C. Temporary mulches such as loose hay, straw, netting, wood cellulose or agricultural silage.

D. Fence stakes shall be metal stakes a minimum of 54 inches in length.

E. Stone check dams shall be spaced according to the Plans.

F. Stone Sediment Barriers or SiltSacks ™, or approved equal for inlet protection.

G. High Density Poly-Ethylene (HDPE) Filters or Silt-Saver™, or approved equal for inlet protection.

H. A stabilized construction entrance shall be constructed temporarily.

I. Riprap for slopes, culvert, storm drain inlet, and outlet aprons.

J. Water for dust control.

K. Wattle check dams shall be spaced according to plans.

L. Erosion control blankets and/or turf reinforcement mats to protect seed and prevent erosion on slopes.

PART 3 – EXECUTION

3.1 PREPARATION

A. Review site erosion and sediment control plan attached to this section of the specifications.

B. Deficiencies or changes in the erosion control plan as it is applied to current conditions will be brought to the attention of the Engineer for remedial action.

3.2 IMPLEMENTATION

A. Provide catalog cuts and information concerning the erosion control products which will be used for construction for review by the Engineer.

B. Provide information concerning the installation of the erosion and sedimentation control including anchorage trench provisions and anchorage devices and spacing for review by the Engineer.

C. Provide construction exit pad in accordance with the erosion and sediment control plan and in accordance with the approved installation procedures.

D. Place erosion control systems in accordance with the erosion and sediment control plan and in accordance with approved installation procedures.

E. The Engineer has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations. The Owner has the authority to direct the Contractor to provide immediate permanent or temporary pollution control measures. The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practical time to minimize the need for temporary controls. Cut slopes shall be permanently seeded and mulched as the excavation proceeds to the extent considered desirable and practical.

F. The temporary erosion control systems installed by the Contractor shall be maintained as directed by the Engineer to control siltation at all times during the life of the Contract. The Contractor must respond to any maintenance or additional work ordered by the Engineer within a 48 hour period.

G. Slopes that erode easily shall be temporarily seeded as the work progresses according to the ALDOT seeding schedule or according to the seeding schedule contained in the plans.

H. Remove and properly dispose of accumulated silt and sediment from all erosion control measures on a daily basis off site unless material is reusable.

I. Remove and properly dispose of all trash and sediments accumulated in existing and new storm drainage inlets, structures, and pipes on a daily basis off site unless material is reusable.

J. Provide temporary diversion berms and ditches as required during construction to protect work areas from up-slope runoff and/or to divert sediment-laden water to appropriate sediment control devices, traps, or stabilized outlets.

K. Provide water trucks or other adequate method for controlling dust throughout the construction period.

END OF EROSION & SEDIMENTATION CONTROL

SECTION 31 3116
TERMITE CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Soil-applied chemical treatment.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related work specified elsewhere includes:
   1. Section 03 3100 - Concrete.
   2. Section 31 2000 - Earth Moving.

1.03 DESCRIPTION OF WORK

A. Work described in this section includes soil treatment for termite control, for use and application below any new on-grade interior floor slabs, and also where any existing slabs may be opened or removed for any new, repair, replacement, or other subgrade work at interior of building and/or within interior perimeter exterior walls.

1.04 REFERENCE STANDARDS

A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; 2019.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.
   1. Include the EPA-Registered Label for termiticide products

C. Manufacturer's Instructions: Indicate caution requirement.

D. Qualification Data: For Installer of termite control products.

E. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following:
   1. Date and time of application.
   2. Moisture content of soil before application.
   3. Brand name and manufacturer of termiticide.
   4. Quantity of undiluted termiticide used.
   5. Dilutions, methods, volumes, and rates of application used.
   6. Areas of application.
   7. Water source for application.

F. Submit completed forms for required warranties, guarantees, and bonds for acceptance, prior to beginning work.

G. Executed warranty.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of type specified, with minimum 3 years of documented experience.

B. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work, including preparation of substrate and application.

C. Source Limitations: Obtain termite control products through one source and from a single manufacturer for each product.

D. Use only termiticides which bear a Federal registration number of the U.S. Environmental Protection Agency.
   1. Formulate and apply termiticides according to the EPA-Registered Label.

E. Mix treatment solution on site, in presence of Contractor's Superintendent, using clean potable water and new termiticide delivered to site in undamaged, original, unopened, and factory-sealed containers.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable code for requirements for application, application licensing, and authority to use toxicant chemicals, and comply with EPA regulations.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of toxicants where required.

1.08 SEQUENCING

A. Apply toxicant immediately prior to installation of vapor barrier under slabs-on-grade.

1.09 JOB CONDITIONS

A. Restrictions: Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.

B. Environmental Limitations: To insure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year installer's warranty against damage to building caused by termites.
   1. Provide paid-up and bonded guarantee for a period of five (5) years from date of treatment, signed by the Applicator and Contractor. Paid-up guarantee shall include annual inspection during the five (5) years and an agreement to renew the bond annually after the five (5) years is up, on payment by the Owner of an annual fee.
   2. Inspect annually and report in writing to Owner. Provide inspection service for 5 years from Date of Substantial Completion.
   3. A specimen of the form of guarantee and the bond shall be submitted for approval before the work begins.

C. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work consisting of applied soil termiticide treatment will prevent infestation of subterranean termites, including Formosan termites (Coptotermes formosanus). If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
   1. Warranty Period: Five years from date of Substantial Completion.

D. Wood Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work consisting of applied wood termiticide treatment will prevent infestation of subterranean termites, including Formosan termites (Coptotermes formosanus). If subterranean termite damage is discovered during warranty period, repair or replace damage caused by termite infestation and treat replacement wood.
   1. Warranty Period: 12 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 CHEMICAL SOIL TREATMENT

A. Toxicant Chemical: EPA Title 7, United States Code, 136 through 136y approved; synthetically color dyed to permit visual identification of treated soil.

B. Manufacturers/Products: Subject to compliance with requirements, provide one of the following termiticide products:
   1. Aventis Environmental Science USA LP; Product "Termidor".

2. Bayer Environmental Science Corp; Product "Premise 75, Premise Pre-Construction, or Premise Pro": www.nobugs.com.
3. Nisus; Product "Bora-Care": www.nisuscorp.com.
4. Syngenta Professional Products: www.syngentaprofessionalproducts.com.

C. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

D. Diluent: Recommended by toxicant manufacturer.
1. Fuel oil will not be permitted as a dilutent.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that soil surfaces are unfrozen and dry to absorb toxicant, ready to receive treatment.

B. Verify final grading is complete; see Section 31 2200.

C. Verify utility trenches are wide enough to receive application.

D. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.
1. Proceed with application only after unsatisfactory conditions have been corrected.

3.02 PREPARATION:

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.03 APPLICATION - CHEMICAL TREATMENT

A. Comply with requirements of U.S. EPA and applicable state and local codes.
1. Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

B. Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

C. Spray apply toxicant in accordance with manufacturer's instructions.

D. Apply toxicant at following locations:
1. Under Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment.
a. Under slab-on-grade structures, treat soil before concrete footings and slabs are placed, using the following rates of application (unless manufacturer recommends otherwise):

1) Apply four (4) gallons of chemical solution per ten (10) linear feet to soil in critical areas under slab, including entire inside perimeter inside of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers.
2) Apply one (1) gallon of chemical solution per ten (10) square feet as an overall treatment under slab and attached slab areas where fill is soil or unwashed gravel. Apply 1-1/2 gallons of chemical solution to areas where fill is washed gravel or other coarse absorbent material.
3) Apply four (4) gallons of chemical solution per ten (10) linear feet of trench, for each foot of depth from grade to footing, along outside edge of building. Dig a trench six (6) inches to eight (8) inches wide along outside of foundation to a depth of not less than twelve (12) inches. Punch holes to top of footing on not more than twelve (12) inches on center and apply chemical solution. Mix chemical solution with the soil as it is being replaced in trench

2. In Crawl Spaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
   a. In crawl-space and basement structures, treat soil along exterior and interior walls of foundations with shallow footings as specified above for exterior of slab-on-grade structures. Treat soil under or around crawl-space structures using the following rates of application (unless manufacturer recommends otherwise):
      1) Apply four (4) gallons of chemical solution per ten (10) linear feet of trench along inside of foundation walls, along both sides of interior partitions, and around piers and plumbing. Do not apply an overall treatment in crawl spaces.
      2) Apply four (4) gallons of chemical solution per ten (10) linear feet of trench, for each foot of depth from grade to footing, along outside of foundation walls.
      3) Apply one (1) gallon per ten (10) square feet of soil surface as an overall treatment, where attached concrete structures are on fill or ground.
3. Foundations: At Both Sides of Foundation Surface: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
4. At hollow masonry foundations or grade beams:
   a. Treat voids at rate of two (2) gallons per ten (10) linear feet (unless manufacturer recommends otherwise), poured directly into the hollow spaces.
5. Masonry: Treat voids.
6. At expansion joints, control joints, and areas where slabs will be penetrated:
   a. Apply at rate of four (4) gallons per ten (10) linear feet of penetration (unless manufacturer recommends otherwise).
7. Soil Within 10 feet (3 m) of Building Perimeter For a Depth of 1 foot .

E. Under slabs, apply toxicant immediately prior to installation of vapor barrier.

F. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.

G. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.

H. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

I. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

J. Re-treat disturbed treated soil with same toxicant as original treatment.
   1. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

K. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

L. Post signs in areas of application warning workers that soil termiticide treatment has been applied. Remove signs when areas are covered by other construction.

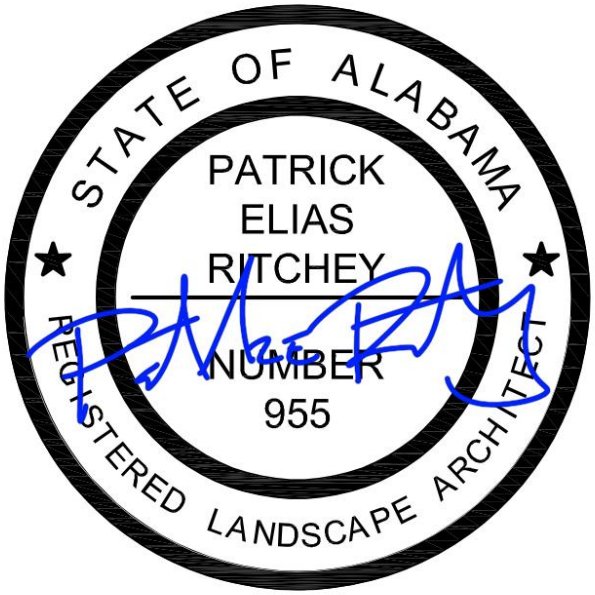
3.04 PROTECTION

A. Do not permit soil grading over treated work.

B. Protect applications from damage after completion. Repair disturbances according to manufacturer's written instructions.

END OF SECTION

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STATE OF ALABAMA
PATRICK
ELIAS
RITCHEY
NUMBER
955
REGISTERED LANDSCAPE ARCHITECT

SECTION 32 1216

ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to this Section.

B. Related work described elsewhere includes:

.. Section 31 2000 - "Earth Moving"
.. Section 32 1313 - "Concrete Paving"
.. Section 32 1613 - "Curbs and Gutters"

1.2 DESCRIPTION OF WORK

A. Work described in this section includes new bituminous paving, a new base, and otherwise as indicated on drawings.

B. Work shall also include pavement patching for any utility trenches under existing paving and this Contract, with prepared subgrade, 8" crushed aggregate base, 6 inch thick 3,000 psi concrete, prime coat, and 1-1/2 inches bituminous concrete overlay, and as indicated on the Drawings.

1. Pavement patch shall extend 9" to 1'-0" beyond each side or edge of trench, and to abut flush with edge where existing paving was cut out.

1.3 QUALITY CONTROL

A. Certifications: The Contractor shall submit to the Architect copies of certificates from suppliers of bituminous materials and other manufactured items, certifying that these products comply with specifications and standards listed hereinafter.

1. All asphalt used for pavement shall be produced by a plant certified by the Alabama Department of Transportation (ALDOT).

B. Standard Specifications: Unless otherwise noted, all specifications referred to shall be the "Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction", latest edition.

C. Testing: All laboratory and field testing required to ensure compliance with these specifications will be performed by an independent testing laboratory. Refer to Section 01 0150 - "Special Conditions," for additional information.

1.4 JOB CONDITIONS

A. Any base or sub-base areas damaged by weather or construction operations shall be scarified, remixed and recompacted in accordance with requirements before application of the prime coat.

B. Special care and attention shall be given to be certain that paving operations and/or equipment do not cause damage to any existing and/or new buildings, structures, or improvements which are to remain.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide the paving system(s) indicated on the Drawings, installed in accordance with Part 3 of this Section, and referenced standards.

PART 3 - EXECUTION

3.1 PRIME COAT

A. Application rates and construction requirements shall be as specified in ALDOT Section 401, Bituminous Surface Treatments, for a Bituminous Treatment Type "A" which is a prime coat.

3.2 TACK COAT

A. Construction requirements, including preparation of the existing surface or substrate and maximum application rates, are specified in ALDOT Article 405.03.

3.3 PLANT MIX BITUMINOUS CONCRETE BINDER LAYER AND BITUMINOUS CONCRETE WEARING SURFACE

A. Construction requirements, including finished surface tolerance, density requirements, and maintenance and protection shall be as specified in ALDOT Articles 410.03 through 410.07, 327.03 and 424.04, as applicable. Rate of application shall be not less than the number of pounds per square yard for a 1-inch wearing surface or pavement patching layer, pro-rated for other thicknesses, as required by referenced ALDOT Specifications.

3.4 CRUSHED AGGREGATE BASE

A. Construction requirements shall comply with the ALDOT Specifications for the materials indicated, including in part, applicable portions of Section 825, Type B and ALDOT Section 301; compacted in accordance with the recommendations made in the geotechnical investigation.

3.5 COMPACTION EQUIPMENT

A. Compaction equipment shall be self-propelled, capable of compacting the mixture throughout the depth of the layer while it is still in a workable condition without damage to the material.

1. Self-propelled rollers shall have a minimum weight of 10 tons.

3.6 PAVEMENT PATCH

A. Saw cut perimeter of existing paving to a neat straight line where removal is indicated and/or required.

1. Protect edges of paving and base exposed to prevent cracking, breaking-up, wash-out, erosion, and/or other damage; apply prime coat as specified and at all such vertical edges prior to placing new pavement.

B. Patch pavement with components stated in Paragraph 1.2-B above, in compliance with each component's specified requirements, and as per details and sections on Drawings, if any.

END OF ASPHALT PAVING

SECTION 32 1313

CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related work specified elsewhere includes:

.. Section 31 2000 - "Earth Moving"
.. Section 03 3100 - "Concrete"
.. Section 07 9000 - "Joint Sealers"

1.2 DESCRIPTION OF WORK:

A. Extent of portland cement concrete paving is shown on drawings, including exterior walks, paving, entry pads, dumpster pads, and mechanical equipment pads.

1.3 QUALITY ASSURANCE:

A. Codes and Standards: Comply with "Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction," latest edition, and local governing regulations if more stringent than herein specified.

B. Testing: All laboratory and field testing required to ensure compliance with these specifications will be performed by a qualified independent testing laboratory. Refer to Section 01 0150 - "Special Conditions", for additional information and requirements.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Forms:

1. Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

2. Use flexible spring steel forms or laminated boards to form radius bends as required.

3. Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.

B. Welded Wire Mesh:

1. Welded plain cold-drawn steel wire fabric, ASTM A 185.

a. Size: 6” x 6” #6, unless indicated otherwise.

2. Furnish in flat sheets, not rolls, unless otherwise acceptable to Engineer, for all concrete paving subject to possibility of bearing the weight of vehicular traffic.

3. Furnish in rolls for all concrete paving accessible only to pedestrian traffic, unless indicated otherwise on structural drawings.

4. Locations for Use: All concrete pads and paving, at 1/3 of total depth of concrete from top of slab.

C. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 40 or 60.

D. Concrete Materials: Comply with requirements of Section 03 3100 - “Concrete”, for concrete materials, admixtures, bonding materials, and other materials as required.

E. Expansion Joint Materials: Comply with requirements of Section 07 9000 - “Joint Sealers” for preformed and pourable expansion joint fillers and sealers.

F. Curing and Sealing Compound: Conform to TT-C-800, with 30% solids content minimum.

2.2 CONCRETE MIX, DESIGN AND TESTING:

A. Comply with requirements of Section 03 3100 - “Concrete”, for concrete mix design, sampling and testing, and quality control, and as herein specified.

B. Design mix to produce normal-weight concrete consisting of portland cement, aggregate, water-reducing or high-range water-reducing admixture (super-plasticizer), air-entraining admixture and water to produce the following properties:

1. Sidewalks, curbs and gutters, entry pads, and mechanical equipment pads subject only to pedestrian traffic:

a. Compressive Strength: 3,000 psi, minimum at 28 days.
b. Maximum Slump: 3"
c. Air Content: 2.5% to 6%
d. Thickness: 6", unless indicated otherwise.
e. Compacted Subgrade: 6" crushed aggregate base on compacted subgrade (98% S.P.D.).

2. Paving and pads subject to vehicular traffic, valley gutters, dumpster pads, and where indicated:

a. Compressive Strength: 4,000 psi, minimum at 28 days (minimum 550 psi flexural strength) in accordance with ALDOT Section 450 – "Portland Cement Concrete

Pavement", of the Alabama Department of Transportation, Standard Specifications for Highway Construction, most current edition.

b. Maximum Slump: 3.5”
c. Air Content: 2.5% to 6%
d. Thickness: 6", unless greater thickness is indicated on the Drawings.
e. Subgrade: Unless otherwise indicated on the Drawings, 6" dense graded aggregate base, ALDOT Section 825, Type B (98% M.P.D.), installed in accordance with construction requirements for the materials indicated, including in part, applicable portions of Section 825 and Section 301.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION:

A. Remove loose material from compacted subbase surface immediately before placing concrete.

B. Proof-roll prepared subbase surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

C. Subgrade shall be approved by the Owner's Geotechnical Engineer before paving begins.

3.2 FORM CONSTRUCTION:

A. Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork for grade and alignment to following tolerances:

1. Top of forms not more than 1/8" in 10'.

2. Vertical face on longitudinal axis, not more than 1/4" in 10'.

C. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

3.3 REINFORCEMENT:

A. Locate, place and support reinforcement as specified in Section 03 3100 – “Concrete”, unless otherwise indicated. Install welded wire fabric in as long lengths as practicable, lapping at least on mesh.

3.4 CONCRETE PLACEMENT:

A. Comply with requirements of Section 03 3100 - “Concrete”, for mixing and placing concrete, and as herein specified.

B. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase, if required, to provide a uniform dampened condition at time concrete is placed. Do not

place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with core to prevent dislocation of reinforcing, dowels, and joint devices.

1. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2-hour, place a construction joint.

3.5 JOINTS:

A. General: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

B. Weakened-Plane (Contraction) Joints:

1. Provide weakened-plane (contraction) joints, sectioning concrete into areas as shown on drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness, as follows below.

2. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.

3. Sidewalks shall be scored at 5-foot intervals unless otherwise indicated.

C. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for a period of more than 1/2-hour, except where such placements terminate at expansion joints.

D. Expansion Joints:

1. Provide expansion joints with premolded joint filler at locations abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.

2. Extend joint fillers full-width and depth of joint.

3. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together.

4. Expansion joints for sidewalks shall be placed at 30-foot maximum intervals and along all intersections with other walks, steps, curbs, or other vertical surfaces.

E. Fillers and Sealants: Comply with the requirements of Section 07 9000 - “Joint Sealers”, for preparation of joints, materials, installation and performance.

3.6 CONCRETE FINISHING:

A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Using hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

C. Work edges of slabs and formed joints with an edging tool, and round to 1/4" radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

D. After completion of floating and troweling, when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

1. Light and smooth broom finish, by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation as required to provide a fine line texture acceptable to Architect.

E. On inclined slab surfaces, provide a coarse, non-slip finish by scoring surface with a stiff-bristled broom, perpendicular to line of traffic.

F. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Architect.

1. Provide rubbed finish for exposed edges of concrete work, and apply light and smooth broom finish.

3.7 CURING:

A. Protect and cure finished concrete paving, complying with applicable requirements of Section 03 3100 - “Concrete”. Use curing and sealing compound or approved moist-curing methods.

B. Begin initial curing as soon as free water has disappeared from exposed surfaces. Where possible, keep continuously moist for not less than 72 hours. Continue curing by use of moisture-retaining cover or membrane-forming curing compound. Cure formed surfaces by moist curing until forms are removed. Provide protections as required to prevent damage to exposed concrete surfaces.

3.8 REPAIRS AND PROTECTIONS:

A. Repair or replace broken or defective concrete, as directed by Architect.

B. Drill test cores where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy resign grout.

C. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

1. Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

END OF CONCRETE PAVING

SECTION 32 1613

CURBS AND GUTTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division I Specification Sections, apply to this section.

B. Related work specified elsewhere includes:

.. Section 31 2000 - "Earth Moving"
.. Section 32 1313 - "Concrete Paving"
.. Section 03 3100 - "Concrete"
.. Section 07 9000 - "Joint Sealers"

1.2 DESCRIPTION OF WORK

A. Work described in this section includes the construction of new concrete curbs and gutters, and/or straight curbs where indicated, and patching between any existing paving and new curb and gutters, sidewalks, etc., to match existing pavement.

B. Refer to Drawings and Owner's Report of Geotechnical Exploration, for additional information and base requirements.

C. Refer to Section 31 2000 - "Earth Moving" for subgrade requirements below and beyond curbs and gutters.

D. Refer to Section 32 1313 - "Concrete Paving", for valley gutters, turn-outs, and paving.

1.3 QUALITY CONTROL

A. Certifications: The Contractor shall submit to the Architect copies of certificates from suppliers of ready-mix concrete, reinforcing steel, curing material, joint fillers, and other manufactured items, certifying that these products comply with the specifications and standards listed hereinafter.

B. Standard Specifications: Unless otherwise noted, all specifications referred to shall be the Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction, latest edition.

C. Testing: All laboratory and field testing as required to ensure compliance with these specifications shall be performed by a qualified independent testing laboratory. Refer to Section 01 0150 - "Special Conditions", for additional information.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Concrete shall be Class "A", Type 4 (3,000 psi), in accordance with Section 501, "Structural Portland Cement Concrete", of the Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction, latest edition. A modified mix shall be used if optional machine laid curb and gutter is constructed.

B. Reinforcing steel, where called for on the drawings, shall meet the requirements of Section 502, "Steel Reinforcement".

C. Curing material shall be either burlap cloth, waterproof paper, polyethylene sheeting, or impervious membrane specified in ALDOT Articles 830.01 and 830.02.

D. Joint filler and sealer for expansion and construction joints shall meet the appropriate requirements of ALDOT Section 832, and Section 07900 - "Joint Sealers" herein.

E. Asphalt for repairs shall comply with referenced ALDOT Specifications, and city requirements, and shall match existing pavement at location(s) requiring patching.

PART 3 - EXECUTION

3.1 CURBS AND GUTTERS

A. Comply with requirements of Section 32 1313 - "Concrete Paving," Section 03 3100 - "Concrete," and the following:

1. Construction requirements, including foundation, forms, sections, joints, placing and finishing concrete, curing and protection, and backfilling shall be as specified in Article 623.03. Curbs and gutters shall match the profile of existing adjoining curb and gutter, if any, and otherwise as detailed.

2. Curb and gutter shall be constructed in sections having a maximum length of 10-feet. Transverse expansion joints with filler and joint sealer shall be installed at all curb returns and in curb and gutter at intervals not exceeding 40-feet. Similar joints shall be installed behind the curb where sidewalks adjoin the curb and gutter, and at all fixed objects which adjoin or extend through the curb and gutter.

3. Care shall be exercised that "tilt-out" curb and gutter is installed where pavement slopes away from the curb, and that 10-foot long transition sections are used where required to transition between "standard" and "tilt-out" curb and gutter.

3.2 REPAIRS AND PROTECTIONS

A. Repair or replace broken or defective concrete, as directed by Architect.

B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14-days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

1. Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

END OF CONCRETE CURBS AND GUTTERS

SECTION 32 1723

PAVEMENT MARKING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work described in this section includes marking of graphic symbols, lane separations, parking stripes, and lettering on concrete and asphalt pavements, if any, at locations indicated and as shown on the Drawings.
B. Related work specified elsewhere includes:
.. Section 32 1216 - "Asphalt Paving"
.. Section 32 1313 - "Concrete Paving"

1.2 QUALITY CONTROL

A. Certifications: The Contractor shall submit to the Architect copies of certificates from suppliers of materials, certifying that these products comply with specifications and standards listed hereinafter.
B. Standard Specifications: Unless otherwise noted, all specifications referred to shall be Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction, most current edition.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Paint for pavement marking shall be, traffic marking paint complying with Section 856, of the ALDOT specifications, and as follows:

1. Class 1, Type A (reflective) in public Right-of-Ways.
2. Class 1, Type B (non-reflective) within property lines of this project's site, 2 coats.

PART 3 - EXECUTION

3.1 PAVEMENT MARKING:

A. Each individual painted parking stripe shall be 4-inches wide, and shall be laid out as indicated on the drawings. Construction requirements shall conform to the applicable parts of Article 701.03 of the ALDOT Specifications for Class 1, Type as specified, traffic stripe.

1. Color shall be white for asphalt, yellow for concrete pavement, and international blue for striping and graphics for parking spaces for people with disabilities.
2. Use same materials and construction methods for any arrows and symbols indicated on paved areas.
3. Mark paving at each space for the people with disabilities with acceptable international graphics symbol, unless otherwise indicated, approximately 4' x 4' in

size. Locate centered in space width and approximately 2'-0" from end of space where vehicle enters.

END OF PAVEMENT MARKING

SECTION 32 3300
SITE FURNISHINGS

PART 1- GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and General provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections apply to the work of this Section.

B. Sections 02751 – "Portland Cement Concrete Paving".

C. Section 03310 – "Concrete".

1.02 DESCRIPTION OF WORK:

A. This Section includes the following:
   a. Trash Receptacles.
   b. Picnic Tables
   c. Wood Bench

B. The extent of site is indicated of the drawings.

1.03 SUBMITTALS:

A. Submit the following:

1. Manufacturer's specifications and product data for each type of site and street furnishing.

2. Shop Drawings and Installation Drawings: Submit for each type of site furnishing.

3. Where color and finish variations are available, submit finished physical samples of materials for review and selection.

4. Warranty: Submit warranty for fixture made out in Owner's name.

1.04 Warranty:

A. Provide manufacturer's advertised warranty on furnishings.

PART 2- PRODUCTS

2.01 GENERAL:

A. Furnish and install site furnishings in the quantities indicated.

2.02 TRASH RECEPTACLE:

A. Litter Receptacle, 30 gallon capacity, with polyethylene liner.

B. Receptacle formed of 11-gauge steel.

C. Finish: Powdercoat, in color selected by Architect from manufacturer's full range of colors.

D. Product/Manufacturer:
   a. Petoskey, with hinged lid style, as manufactured by LandscapeForms: www.landscapeforms.com
   b. For substitutions: See Section 01600 – Product Requirments.

2.03 PICNIC TABLE WITH BENCHES:

A. Picnic table with benches attached, 6 feet long. Bolted to concrete patio slab.

B. Product/Manufacturer:
   a. Larchmont Picnic Table #4859 Picnic Table, 6' long: www.countrycasual.com
   b. For substitutions: See Section 01600 - Product Requirements.

2.04 WOOD BENCH:

A. Surface mounted wood bench, 6 feet long. Bolted/attached to concrete patio slab.

B. Product/Manufacturer:
   a. Wellspring Collection, 72 inch bench, 17.5" seat height, 25"D x 34"H x 72"L, as manufactured by LandscapeForms: www.landscapeforms.com.
   c. For substitutions: See Section 01600 - Product Requirements.

PART 3-EXECUTION

3.01 SYSTEM DESIGN:

A. Install at locations indicated and only with prior confirmation by the Architect, in strict accordance with manufacturer's current written instructions and recommendations.

B. Provide and install all necessary anchors and fasteners. Where requested, paint bolt heads to match surrounding finish or in another color, as selected by Architect.

B. Coordinate installation and fitting with the work of other trades.

3.02 INSTALLATION:

A. Install in accordance with manufacturer's recommendations.

3.03 CLEANING AND PROTECTION:

A. Clean furnishings of all foreign matter and touch-up marred finishes in accordance with manufacturer's current written recommendations.

B. Clean Repair any items damaged prior to Substantial Completion and/or as a result of the work of this Contract, subject to Architect's and Owner's acceptance, or replace.

END OF SECTION 32 3300

SECTION 32 8420
UNDERGROUND IRRIGATION
(PERFORMANCE SPECIFICATION)

PART 1- GENERAL

1.01 SUMMARY:

A. Work Included: Provide an underground sprinkler system based on these specifications and as required for complete coverage of designated landscaped areas. Work includes, but is not limited to:
   1. Landscape sprinkler system.
   2. Automatic controller, remote valves and wiring.
   3. Responsibility for full and complete coverage of all designated irrigated areas denoted on plan sheet L7.00, including necessary adjustments during installation, maintenance and guarantee periods at no additional cost.
   4. Specified maintenance and guarantee period.

1.02 RELATED WORK:

A. Landscape Work- Section 32 9000.

1.03 QUALITY ASSURANCE:

A. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with the latest rules of the National Electric Code for all electrical work and materials.

B. Manufacturer Qualifications: Provide underground sprinkler system as complete unit produced by a single acceptable manufacturer, including heads, valves, piping circuits, controls, and accessories.

1.04 SUBMITTALS:

A. Submit the following:
   1. Project Record Drawings: Provide separate and complete Project Record Drawings prepared in accordance with the provisions of Division 1 Series of these Specifications.

1.05 JOB CONDITIONS:

A. Utilities: Determine location of underground utilities and perform work in a manner which will avoid all possible damage. Hand excavate, as required. Repair damage to utility owner's satisfaction at no additional cost.

PART 2- PRODUCTS

2.01 MATERIALS:

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. Rain Bird Sprinkler Mfg. Corp.
2. Hunter Industries Incorporated.

B. Pipe: PVC plastic pipe, ASTM D-1785, Schedule 40, for sleeves, mainline, and pipe under paving; PVC plastic pipe D-2241, SDR/PR 200 elsewhere.

C. Pipe Fittings: For PVC plastic pipe, ASTM D-2466 socket fittings with ASTM D-2564 solvent cement.

D. Valves: Manufacturer's standard, of type and size indicated, and as follows. Provide cast bronze bodies, unless otherwise indicated.
1. Manual Station Valves: Globe valves.
2. Key Operated Valves: Manual valves, fitted for key operation. Furnish 3 valve keys.
3. Automatic Circuit Valves: Globe valves operated by low-power solenoid, normally open manual flow adjustment.
4. Automatic Drain Valves: Designed to open for drainage when line pressure drops below 3 psi.

E. Backflow Preventer: Watts No. 709 Series Backflow Preventer or approved equal.

F. Water Meter: Provide separate water meter, if required, for irrigation system sized as per manufacturer's recommendation.

G. Sprinkler Heads: Manufacturer's standard unit designed to provide uniform coverage over entire area of spray at available water pressure, as follows:
1. Flush Surface: Fixed pattern, with screw-type flow adjustment.
2. Pop-Up Spray: Fixed pattern, with screw-type flow adjustment and stainless steel retraction spring.
3. Shrubbery: Fixed pattern, with screw-type flow adjustment.
4. Pop-Up Rotary Spray: Gear drive, full circle and adjustable part circle type.

H. Valve Box: Precast by Ametek, or approved equal.

I. Valve Cover and Frame: By Ametek, with provision for locking.

2.02 AUTOMATIC CONTROL SYSTEM:

A. General: Provide low voltage system manufactured expressly for control of automatic circuit valves of underground sprinkler systems. Provide unit of capacity to suit number of stations as indicated.

B. Exterior Control Enclosure: Manufacturer's standard weatherproof enclosure with locking cover, complying with NFPA 70 (National Electric Code).

C. Transformer: To convert building service voltage to control voltage of 24 volts.

D. Station Control: Each station variable from approximately 5 to 60 minute. Include switch for manual or automatic operation of each circuit.

E. Timing Device: Adjustable, 24-hour and 7 or 14 day clocks to operate any time of day and skip any day in a 7 or 14 day period. Allow for manual or semi-automatic operation without disturbing preset automatic operation.

PART 3-EXECUTION

3.01 SYSTEM DESIGN:

A. Design Pressures: Follow manufacturer's performance recommendations for specific head type and intended coverage.

B. Location of Heads: Lay out heads to achieve complete and uninterrupted coverage and minimize water wasted by overthrow on pavement.

3.02 TRENCHING AND BACKFILLING:

A. General: Excavate straight and true with bottom uniformly sloped to low points. Protect existing or previously installed lawns and plantings. Remove and replant as necessary to complete installation. Replace damaged plants with new to match existing.

B. Trench Depth: Excavate trenches to a depth of 3" below invert of pipe, unless otherwise indicated.

C. Minimum Cover: Provide 12" minimum cover over top of installed main line piping, 12" minimum cover over lateral lines, or meet local requirements for minimum cover, whichever is greater.

D. Backfill: Backfill with clean material from excavation. Remove organic material as well as rocks and debris larger than 1" diameter. Place acceptable backfill material in 6" layers, compacting each layer.

E. Pavements: Where existing pavements must be cut to install landscape irrigation system, cut smoothly to straight lines 6" wider than trench. Wherever possible, bore under paved areas. Excavate trench to required depth and width. Trench depth shall be a minimum equal to depth of pavement and base, and of sufficient depth to meet minimum coverage requirements. Remove cut-out pavement and excavated material from the site. Replace pavement cuts with equal materials and finishes.

F. Sleeving: Provide schedule 40 PVC Sleeving for all piping under new paving.

3.03 INSTALLATION:

A. General: Comply with requirements of the Standard Plumbing Code and all local codes and ordinances.

B. Connection to Main: Determine main line location. Connect to existing main line in such a manner as to reduce wasted pipe. Install new valve and union.

C. Maintain uninterrupted water service to building during normal working hours. Coordinate temporary water shut-off with Owner.

D. Backflow Preventer: Provide union on downstream side of main line. Assembly shall be housed in an above ground, waterproof housing. This housing shall be accessible for periodic testing purposes. Irrigation Contractor is to consult local codes and authorities to assure proper installation of the assembly.

E. Station Valves: Install in valve box, arrange for easy adjustment and removal. Provide union on downstream side. Adjust automatic control valves to provide flow rate of rated operating pressure required for sprinkler circuit.

F. Piping:
1. Lay pipe on solid subbase, uniformly sloped without humps or depressions.
2. At wall penetrations, fill the opening around pipe with non-shrink grout. At exterior face, leave a perimeter slot approximately 1/2" wide by 3/4" deep. Fill this slot with backer rod and an acceptable elastomeric sealant. Repair below grade waterproofing disturbed by this work and make penetration watertight.
3. Install PVC pipe in dry weather when temperature is above 40 degrees F. in strict accordance with manufacturer's instructions. Allow joints to cure at least 24 hours at temperatures above 40 degrees F. before testing, unless recommended by manufacturer.

G. Sprinkler Heads: Flush station lines with full head of water and install heads after hydrostatic test is completed.
1. Locate part-circle heads to maintain a minimum distance of 4" from walls and 2" from other boundaries, unless otherwise indicated.

H. Dielectric Protection: Use dielectric fittings at connection where pipes of dissimilar metal are jointed.

3.04 TESTING:

A. General: Notify Architect in writing when testing will be conducted. Conduct tests in presence of Architect.

B. Hydrostatic Test: Test water piping and valves, before backfilling trenches, to hydrostatic pressure of not less than 100 psi. Piping may be tested in sections to expedite work. Remove and repair or replace piping, connections, valves which do not pass hydrostatic testing.

C. Operational Testing: Perform operational testing after hydrostatic testing is completed, backfill is in place, and sprinkler heads adjusted to final position. Demonstrate to Architect that system meets coverage requirements and that automatic controls function properly. Coverage requirements are based on operation of one circuit at a time.

D. After completion of grading and planting, carefully adjust sprinkler head locations and heights so they will furnish complete coverage.

3.05 CODES AND ORDINANCES

A. All material and operations shall conform to tall applicable codes and ordinances. It is the Contractor's responsibility to investigate and follow all regulations.

3.06 PERMITS AND FEES

A. The Contractor shall obtain, at his expense, all required permits and shall pay all required fees, including impact fees from local governments that may apply. Any penalties imposed due to failure to obtain any permit or pay any fee shall be the responsibility of the Contractor.

3.07 WARRANTY AND GUARANTEE

A. The Contractor shall furnish a certificate of warranty registration and a written guarantee of work and materials for a one year period from the date of final acceptance of the Irrigation System by the Owner and the Designer.

END OF SECTION 32 8420

SECTION 32 9000
LANDSCAPE WORK

SECTION 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary and General Requirements apply to the work specified herein.
B. Irrigation Performance - Section 32 8420.
C. Landscape Maintenance - Section 32 9700.

1.2 DESCRIPTION:

A. Provide all labor, equipment, materials and services necessary to complete the Work of this Section, including:

1. Providing, placing, grading topsoil and/or sand for landscape grading as indicated in the Drawings.
2. Providing and installing trees, shrubs, ground covers, and solid sod for landscape planting.
3. Maintenance for thirty days after Substantial Completion, and Two (2) Year Guarantee Period.

1.3 SUBMITTALS:

A. Qualification Data for firms specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include a list of a minimum of five (5) similar projects completed with the last five (5) years with project name, address, names of Architects and Owners, overall description of scope of work, and contract value.

B. Materials Lists:

1. Within ten (10) days of award of Contract, submit a complete list of materials and unit prices demonstrating source, availability, and complete conformance with requirements specified.

2. Substitutions not permitted unless proof is submitted to the Landscape Architect's satisfaction that the material is unavailable as specified.

C. Certificates: Deliver all certificates of inspection to the Engineer.

D. Product Data:

1. Submit manufacturer's product literature, instructions and guaranteed analysis for fertilizer.

1.4 DEFINITIONS:

A. Trees, shrubs, groundcovers, and sod are plant materials listed in Plant Schedule on Drawings.

1.5 JOB CONDITIONS:

A. Coordinate the Work of this Section with that of other trades.

B. Examine conditions under which Work is to be performed and notify Landscape Architect and Landscape Architect in writing of unsatisfactory conditions.

C. Do not perform Work until conditions are satisfactory and acceptable.

D. Notify utility companies, prior to digging, for locations of underground utilities (electrical power, telephone, cable, water, sewer and gas) and perform Work in a manner which will avoid all possible damage. Hand excavate as required.

E. Maintain stakes or other location markers and controls set by others until removal is mutually agreed upon by all parties.

1.6 QUALITY ASSURANCE:

A. Codes and Standards:

1. Applicable Sections of Alabama Highway Department (ALDOT) Standard Specifications for Highway Construction, 2001 Edition as amended.

2. All plant materials to comply with State and Federal laws relating to inspection for disease and insect control.

3. Plant material quality to conform to *American Standard for Nursery Stock*, American Association of Nurserymen, Inc., 1986, ANSI Z-60.1.1

4. Plant Material nomenclature to conform to:

a. *Hortus Third*, a Concise Dictionary of Plants Cultivated in the United States and Canada, MacMillan Publishing Company, Inc., New York, 1976 Edition.

b. Names not listed in the above standard to comply with those most commonly used in the trade.

c. In all cases, botanical names take precedence over common names.

B. Installer Qualifications: Firm shall hold Alabama General Contractor's License for Classification S - Specialty Construction, Subclassification 4 - Landscaping. Firm experienced in the successful installation of a minimum of five (5) projects within the past five (5) years similar in scope, quality, and contract value to that indicated for this project. Firm shall have sufficient manpower, equipment and financial resources to complete the Work of this Section.

C. Personnel: Use adequate numbers of skilled workmen trained and experienced in the Work and familiar with requirements and methods needed for performance of the Work. At all times during planting operations, have on the site a person knowledgeable in horticultural practices as a superintendent.

D. Inspection and Approval:

1. All plant material is subject to inspection and approval in the field or nursery before digging, by the Landscape Architect.

2. All plant materials and other materials are subject to inspection and/or rejection at the site before planting or placing, or at any other time.

3. Attach secure, durable, legible waterproof labels, stating correct botanical and common names as specified, to a least one (1) plant, bundle or container of each plant variety.

4. Remove from site plant materials or other materials not complying with specified requirements within 5 days of rejection.

5. Approval is for visual qualities only and does not relieve the Contractor of his obligation to provide materials and workmanship in full compliance with the requirements of the Contract Documents.

1.7 PRODUCT DELIVERY, STORAGE and HANDLING:

A. Deliver packaged materials in manufacturer's original containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery, and while stored at the site.

B. Deliver all non-packaged or non-containerized materials to site in a manner that will prevent loss, damage, deterioration or contamination.

C. Store all materials in approved locations to prevent loss, damage, deterioration or contamination.

D. Deliver, storage and handling of all plant materials shall conform to ALDOT Specification Section 860.06(c) and the following:

1. Deliver freshly dug plants, which have not been in cold storage or heeled-in.

2. Do not prune prior to delivery.

3. Do not bend or bind trees or shrubs in such a manner as to damage bark, break branches or destroy natural shape.

4. Provide necessary protective covering during transport and delivery.

5. Deliver plants after preparations for planting have been completed and approved, and plant immediately.

1.8 SITE MAINTENANCE:

A. Keep roads, paving and structures adjacent to maintenance operations clean and free of obstructions, mud and debris at all times.

B. Do not permit flushing of roads or disposal of dirt or debris into sewers or drainage ditches.

C. Control dust from maintenance operations.

SECTION 2 - PRODUCTS

2.1 SOIL MATERIALS:

A. Topsoil:

1. This Contractor shall furnish topsoil in sufficient quantity, to complete grading and planting operations as specified.

2. Characteristics of topsoil to be furnished:

a. Fertile, friable, naturally occurring. Free of stones, clay, lumps, hardpan, roots, stumps, branches, sticks and other debris larger than two (2) inches in any dimension; free of noxious weeds, grasses, seeds, plants, extraneous matter and any substance harmful to plant growth. Topsoil from open fields will not be accepted.

b. Ph: 5.0 to 7.0
c. Organic Matter: 5% to 10%
d. Sand: 50% to 70%
e. Silt: less than 30%
f. Clay: 10% to 25%
g. Permeability Rate of 5 x 10 <-3> centimeters or greater at 85% compaction.

B. Notify Engineer of location of proposed topsoil for his inspection before testing or transporting to site.

C. Topsoil testing for furnished topsoil: Sample and test, minimum of three (3) samples, for compliance with specified characteristics. Tests to be performed by soil testing lab approved in advance by Engineer, by this Contractor at his expense. Submit Soil Test Reports to Landscape Architect for approval before transporting topsoil. Amend per recommendations of Soil Test Report and as approved to meet specified characteristics.

2.2 SOIL AMENDMENTS:

A. Fertilizer:

1. Characteristics:

a. Uniform in composition.
b. Dry and free-flowing.
c. Commercially available.
d. Conforming to the State of Federal Fertilizer Laws.

2. Of the formulation recommended in the Soil Test Report as specified.

B. Lime:

1. Ground or crushed agricultural lime.
2. Containing not less than 85% of total carbonates.
3. 90% passing 20-mesh screen.
4. Not less than 50% passing a 60-mesh screen.
5. Dry and free-flowing.
6. Apply at rate specified in Soil Test Report.

2.3 LANDSCAPE PLANTING MATERIALS:

A. Water:

1. Provide fresh water, free of impurities or any substance harmful to plant growth.

2. Provide all hose, attachments, and accessories necessary to complete the Work

as specified.

B. Topsoil: Refer to Paragraph 2.1.A, this Section, for specified topsoil for use in all planting operations.

C. Topsoil Mix:

1. Prepare all topsoil mix used in tree and shrub pits and ground cover beds in the following proportions:

a. 2 parts by volume topsoil as specified. 2.1.A.
b. 1 parts by volume decomposed organic matter, 2.3.E.

2. Add three (3) pounds of 12-6-6 fertilizer to each cubic yard of topsoil mix during the mixing process, for all plants.

D. Decomposed Organic Matter:

1. Well rotted organic matter.

2. Containing no weeds, grasses or plants, their seeds, or any substance harmful to plant growth.

3. Of uniform composition.

4. Acceptable Materials:

a. Mushroom Compost
b. Ground pine bark
c. Approved equal.

E. Mulch:

1. Pine straw on slopes: Free from leaves, twigs, insects, grasses, weeds, plants and their seeds, other foreign material and any substances harmful to plant growth.

2. Ground Pine bark: Free from leaves, twigs, insects, grasses, weeds, plants and their seeds, other foreign material and any substances harmful to plant growth.

F. Solid Sod:

1. Obtain solid sod from sources having growing conditions similar to the area to be planted.

2. Sod shall be true to name and type of the species named in the plant Schedule.

3. Sod shall be 100 percent of the type specified and shall contain no other grasses.

4. Sod shall be well cultivated and weed, disease and insect-free, of good texture, and free from extraneous roots, stones and other foreign material. The presence of nutgrass or other weeds shall be cause for rejection and replacement prior to Substantial completion, or during the Guarantee Period.

I. Plant Material:

1. Definition: Trees and shrubs listed in the Plant Schedule in the Drawings.

2. General:

a. Species, sizes, manner in which to be planted, and approximate quantities to complete the planting as indicated are included in the Plant Schedule.
b. Scientific and common plant names conform to those given in *Hortus Third*, or are those generally accepted in the nursery trade.

3. Quality:

a. Conform to the standards set forth in *American Standard for Nursery Stock.*
b. Standard quality and first-class representatives of their species or variety and true to name and type.
c. Nursery-grown, unless specified otherwise.
d. In compliance with State and Federal laws relating to disease and insect infestation; file certificates with Landscape Architect.
e. Having normal, well-developed branches and vigorous root systems, free from defects, decay, disfigurements, sun scaled, bark abrasions, plant diseases, insect pests or eggs, borers and any and all infestations.

4. Rejection of plants for:

a. Lack of compactness or proper proportion;
b. Week, thin growth in rows too close together;
c. Cut back from larger stock to meet specified requirements;
d. Undersized, dry, cracked or broken balls, or plants that are loose in their balls;
e. Root bound within container or ball;
f. Lacking proper proportion as to height and spread and specified characteristics or plant material;

5. Size:

   a. Sizes and proportions of all plant materials shall equal those recommended by the *American Standard for Nursery Stock* for specified grades.
   b. Measure plants before pruning, with branches in normal position.
   c. Equal or exceed measurements specified in Plant Schedule, which are the minimum acceptable; provide 50-percent of plant material maximum size specified.
   d. Height and spread dimensions: General body mass of plant, not from branch tip to tip.
   e. Well-proportioned as to height; reject plants which meet specified measurements but do not possess an overall balance.

   f. Take caliper measurement on trunk six-inches above natural ground level up to and including four-inch caliper size; twelve-inches above natural ground level for larger sizes.
   g. B&B plants shall have firm natural balls of a diameter and depth not less than that recommended in *American Standard For Nursery Stock.*
   h. Container-grown plants: Conform to standards set forth in *American Standard For Nursery Stock* for container-grown plants.

6. Quantity: Furnish plants in sufficient quantity to satisfy the intent of the Drawings and Specifications. Locate in sufficient quantity to that time is not lost if some plants are rejected.

J. Guying and Staking Materials:

1. Wood Stakes:

   a. Pressure-treated Southern Yellow Pine, or other approved wood, 2-inches x 4-inches x length specified in the Drawings, pointed at one end.
   b. Free from insects and fungi.

2. Wire: Pliable #10 or #12 gauge galvanized steel wire, doubled and twisted.

3. Turnbuckles: As detailed and approved by Landscape Architect.

4. Protective Hose:

   a. Reinforced fiber-bearing rubber hose.
   b. Black.
   c. May be second-hand.
   d. Not less than 2-inches inside diameter.

K. Steel Edging

1. Black polypropylene, 16 (mils.) thickness

a. Acceptable product: 10' x 14ga x 4" Commercial Edging, Manufacturer: Col-met, 3333 Miller Park South Garland, TX 75042 Tel.: (972)494-3900
b. Approved equal.

K. Weed Barrier Fabric

1. Black polypropylene, 16 (mils.) thickness

a. Acceptable product: Pro 5(20 yr, 5oz) Manufacturer: DeWitt Company Highway 61 South, RR3, Box 31, Sikeston, Missouri 63801
b. Approved equal.

SECTION 3 - EXECUTION

3.1 INSTALLATION:

A. Planting Season:

1. A period of acceptable weather conditions, during seasons in which satisfactory results can be expected as determined by acceptable practice in the locality and approved by the Landscape Architect.

2. Commence planting operations as soon as portions of the site are available, as approved by the Landscape Architect.

B. Site Inspection:

1. Examine areas and conditions under which Work is to take place.

2. Inform Landscape Architect in writing, prior to planting, of conditions existing which could be considered detrimental to the successful planting and growth of any plant material, including but not limited to, subsurface drainage conditions, utility locations, subgrade compaction, percolation rate and elevations.

C. Site Preparation:

1. Subgrade will be established by others at 2-inches below finished grade in all

areas to receive planting, and 1-inch for areas to be sodded, unless greater topsoil depth is indicated herein or on Drawings for deeper bed preparation.

a. Topsoil depth for shrub and groundcover beds is 6-inches and is by this Contractor (4" by others, 2" by this contractor).
b. Do not place or spread topsoil in an area until subgrade is approved by Landscape Architect and is acceptable to this Contractor.

2. Remove all vegetative growth from topsoil by approved means before commencing with planting operations.

3. Remove all unwanted vegetative growth from areas designated to receive new planting or sod with chemical herbicide or by other approved means, prior to scarifying and placing topsoil.

4. Remove extraneous matter measuring 1-2-inch or larger in any dimension from top 4-inches of placed topsoil.

5. Uniformly grade areas including adjacent transition areas to line and grade shown on Drawings.

6. Obtain approval of finished grades before proceeding with planting operations; eliminate irregularities and ponding.

7. Protect stockpiled or spread topsoil from erosion by force of wind, water, or other force; re-establish eroded, rutted or settled grades to proper finished grade.

D. Topsoil Mix:

1. Prepare topsoil mix to specification 2.3.C off site, using approved topsoil.

2. Obtain approval of topsoil mix before delivery to site, and prior to commencing planting operations. Do not mix in place with placed topsoil.

3. Place topsoil mix as backfill for tree and shrub pits and beds as drawn. Place 2-inches of topsoil mix in all shrub beds unless otherwise indicated on the Drawings.

4. Protect stockpiled topsoil mix from erosion by force of wind of water, or damaged by traffic.

E. Plant Location Staking:

1. Stake plant locations and areas for approval prior to planting.

2. Do not dig plant pits prior to obtaining Landscape Architect's approval of plant locations.

3. Make adjustments in plant locations as directed.

4. If underground obstructions are encountered in planting areas that would prevent the installation of the plant material, contact the Landscape Architect immediately. Alternate locations may be selected by the D & D at no additional cost to the Owner.

F. Planting:

1. Place plants comprising a planting composition in approved staked locates for approval by Landscape Architect.

2. Planting pits and beds:

a. Drainage:

1) This Contractor is responsible for achieving and maintaining adequate drainage from all planting beds. Use specified drainage system, or other approved means, in all tree pits.

2) 48-hours prior to planting, test each plant pit for adequate drainage.

3) Owner reserves the right to test tree or plant pits at any time, before or after planting, for adequate drainage. Correct immediately any inadequate drainage encountered.

b. Pits are generally circular in outline with vertical sides.
c. Tree pits: 3-feet greater in diameter than ball or root spread.
d. Shrub pits: 1-foot greater in diameter than ball or root spread.

e. Excavate to specified dimensions and dispose of excavated material off site.
f. Prepare as specified in detail Drawings.

3. Setting plants:

a. Set plants uniformly 2-inches to 4-inches higher than surrounding grade or as necessary to provide adequate positive drainage away from roots. Slope soil gradually from saucer.
b. Cut rope, wire or string from top of ball after plant has been set; turn down and bury burlap.

4. Backfilling plants:

   a. Backfill to 2/3 full with specified topsoil mix.
   b. Water thoroughly to eliminate air pockets and settling before filling to grade.
   c. Form shallow saucer at plant pit edge to hold water.
   d. Water in thoroughly.

5. Staking:

   a. Inspect tree trunks for injury, improper pruning and insect infestation; take corrective measure.
   b. Immediately after planting, stake trees as detailed.

6. Pruning:

   a. Do not prune plants without approval.
   b. Prune after plants are in place and *ONLY* at the direction of Landscape Architect.
   c. Main leaders of trees to remain intact.
   d. Paint all cuts over 2-inch diameter with approved tree wound dressing.

7. Finished Grading: Handgrade and rake planting areas so that grades conform to surrounding areas and surface water drains freely.

8. Mulching:

   a. Mulch all plant pits and beds with 4-inch deep specified mulch.
   b. Spread mulch solid in planting beds.
   c. Thickness is uniform throughout.
   d. Mulch for trees shall be eight (8) feet in diameter from base of tree.

G. Solid Sod:

1. Procure and handle sod per ALDOT Section 860.05(b) 1-4.

2. Preparation of Sod Bed:

   a. Spread and scarify amended topsoil as specified.
   b. Rake and otherwise manipulate to form smooth-draining grades, remove all stones and clay lumps 1-inch in diameter or larger.
   c. Leave the surface of the topsoil 1- 1/2-inches below finished grade.
   d. Do not move heavy objects over areas to be sodded after the soil has been prepared. Planting in compacted areas will not be permitted.

e. The finished surface of the areas to be sodded shall be approved by the Landscape Architect prior to sod placement.

3. Solid Sod Placement:

a. Lay sod when sod bed is not excessively wet or frozen, but when soil is damp for a depth of 4-inches.
b. Immediately upon approval of bed preparation, lay sod smoothly, edge-to-edge, with staggered joints.
c. Press firmly into contact with sod bed by tamping or rolling by approved means to eliminate all air pockets, providing a true and even surface, and assuring knitting.

d. Fill cracks between sod blocks with strips of living sod, topsoil, or humus.
e. Water thoroughly by use of sprinkler or spray, without erosive force.

3.2 LANDSCAPE MAINTENANCE:

A. Provide labor, materials, equipment and means for proper maintenance of all materials and workmanship included in the Work of this Section until Substantial Completion and the beginning of the 30-day maintenance period.

B. Maintenance for 30 days after Substantial Completion is included in the Work of this Section.

3.3 SUBSTANTIAL COMPLETION and GUARANTEE:

A. Substantial Completion and Payment:

1. Submit request for inspection of Substantial Completion, with a punch list of contract items to complete, to Landscape Architect at least 1-week prior to anticipated date of inspection.

2. Review the Work jointly with the Landscape Architect for Substantial Completion.

3. Upon completion of repairs and replacements found necessary at time of review, the Landscape Architect will confirm the Date of Substantial Completion of the Work.

4. Substantial Completion constitutes the beginning date of the 2-Year Guarantee Period per the city Landscape Ordinace.

B. Basis of Acceptance:

1. Planted trees and shrubs will be counted as individual units, complete, in place and planted in accordance with plans and specifications. Each unit will include the installed plant, topsoil, topsoil mix, mulch and staking apparatus.

2. Solid sod will be counted in square yards provided and installed, including sod, ground preparation and topsoil, in accordance with plans and specifications.

3. Plant pit drainage will be counted as incidental to the Work, and will not be counted separately for payment.

4. The cost of mobilization (including all provisions of General Requirements, and Maintenance until Substantial Completion as specified herein are considered incidental to the Work and will not be counted as separate items for payment.

C. Guarantee:

1. Guarantee all materials and workmanship for a period of 2-years from the Date of Substantial Completion.

2. During the period of the Guarantee, replace with no additional compensation, and as soon as weather permits, all dead plant materials and all materials not in a thriving condition; replace all other workmanship and materials which are unsatisfactory in the opinion of the Landscape Architect; make good any other damage, loss, destruction, or failure to flourish sufficiently as the result of inferior or defective materials or workmanship, including, but not limited to inadequate drainage.

3. All replacement material shall match the size attained by original materials at the time of the replacement.

4. Remove dead or dying material from the site within 5 days of notice, refer to section 1.6 paragraph F(4).

5. Repair grades and other Work necessitated due to planting replacements.

6. If the replacement is not acceptable during or at the end of the Guarantee Period, the Owner may elect either subsequent replacement or credit. Replacements shall have a 1-year Guarantee from date of replacement.

7. Guarantee applies to losses or damage other than those due to vandalism, Owner neglect, or Acts of Nature, as determined by the Landscape Architect. Acts of Nature, but may not be limited to, high winds of hurricane or tornado force, sleet, hail, freezing rain, and extreme cold (as determined by the Landscape Architect). Contractor agrees to replace losses due to Acts of Nature at fifteen

percent (15%) less than original contract price for the damaged work.

3.4 FINAL INSPECTION and ACCEPTANCE:

A. Contractor is responsible for contacting the Landscape Architect at the end of the Guarantee Period to schedule final inspection. Should the Contractor fail to contact the Landscape Architect at this time, the Guarantee Period is automatically extended until he does so.

B. At the end of the Guarantee Period, submit request for inspection for Final Acceptance to Landscape Architect at least 1-week prior to anticipated date of inspection; include list of Work substantially accepted and list of Work replaced during Guarantee Period.

C. Upon request for inspection, jointly review with Landscape Architect all guaranteed Work for Final Acceptance.

D. Remove tree staking apparatus and saucers from all trees, unless otherwise directed; replace mulch to specified thickness.

E. Upon completion by the Contractor of all required repairs and replacements, the Landscape Architect will confirm the date of Final Acceptance of the Work.

END OF LANDSCAPE WORK

SECTION 32 9700
LANDSCAPE MAINTENANCE

1.0 GENERAL

1.1 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, apply to the work specified herein.

1.2 DESCRIPTION AND SCOPE OF WORK:

A. Provide all labor, products, equipment and services necessary to maintain site landscape work for TWO (2) YEARS after substantial completion.

B. Maintenance includes maintaining all landscape and site work as described herein; The removal of trash, litter, blowing paper, debris, dust and mud from landscape areas and other areas littered as a result of maintenance operations is included.

C. Maintain all plants in a growing, well formed, healthy, and thriving condition, by watering, fertilizing, pruning, spraying, weeding, straightening, replacement, or by other necessary maintenance operations.

1.3 SUBMITTALS:

A Qualification data for firms specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include a list of a minimum of five (5) similar projects completed within the last five (5) years with project name, address, names of Architects and Owners, overall description of scope of work, and contract value.

B. Product Data:

1. Submit manufacturer's product literature, instructions and guaranteed analysis for fertilizer.

C. Maintenance Manual: In a 3-ring binder, typewritten schedule and procedures for annual landscape maintenance program and procedures, with monthly maintenance guidelines, by Contractor.

1.4 JOB CONDITIONS:

A. Coordinate the Work of this Section with that of other trades.

B Examine conditions under which Work is to be performed and notify Owner in writing of unsatisfactory conditions.

D. Determine the extent of underground utilities and impact on proposed installation and maintenance operations.

1.6 QUALITY ASSURANCE:

A. Codes and Standards:

1. All plant materials to comply with State and Federal laws relating to inspection for disease and insect control.

2. Plant material quality to conform to *American Standard for Nursery Stock*, American Association of Nurserymen, Inc., 1986, ANSI Z-60.1.

3. Plant Material nomenclature to conform to:

   a. *Hortus Third*, a Concise Dictionary of Plants Cultivated in the United States and Canada, MacMillan Publishing Company, Inc., New York, 1976 Edition.
   b. Names not listed in the above standard to comply with those most commonly used in the trade.
   c. In all cases, botanical names take precedence over common names.

4. Applicable Sections of the Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction, 2001 edition.

B. Contractor Qualifications:

1. Alabama General contractors License for Classification S - Specialty Construction, Sub-classification 4 - Landscaping.

2. Firm experienced in the successful installation of a minimum of five (5) projects within the past five (5) years similar in scope, quality, and contract value to that indicated for this project. Firm shall have sufficient manpower, equipment and financial resources to complete the Work of this Section.

C. Supervision:

1. Scheduling, operations, installation, and maintenance shall be supervised by a person(s) having one or more of the following qualifications:

   a. Is a Certified Nurseryman.
   b. Is a Licensed Horticulturist.
   c. Has a State Setting and Maintenance License.

D. Inspection and Approval:

1. Immediately remove from site plant materials or other materials not complying with specified requirements.

2. Approval is for visual qualities only and does not relieve the Contractor of his obligation to provide materials and workmanship in full compliance with the requirements of the Contact Documents.

1.7 PRODUCT DELIVERY, STORAGE and HANDLING:

A. Deliver packaged materials in manufacturer's original containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery, and while stored at the site.

B. Deliver all non-packaged or non-containerized materials to site in a manner that will prevent loss, damage, deterioration or contamination.

C. Store all materials in approved locations to prevent loss, damage, deterioration or contamination.

D. Deliver, storage and handling of all plant materials shall conform to ALDOT Specification Section 860.06(c) and the following:

1. Deliver freshly dug plants, which have not been in cold storage or heeled-in.

2. Do not prune prior to delivery.

3. Do not bend or bind trees or shrubs in such a manner as to damage bark, break branches or destroy natural shape.

4. Provide protective covering during delivery.

5. Deliver plants after preparations for planting have been completed and approved, and plant immediately.

1.8 SITE MAINTENANCE:

A. Keep roads, paving and structures adjacent to maintenance operations clean and free of obstructions, mud and debris at all times.

B. Do not permit flushing of roads or disposal of dirt or debris into sewers or drainage ditches.

C. Control dust from maintenance operations.

SECTION 2.0 - PRODUCTS

2.1 WATER:

A. Owner provides potable water.

B. Contractor provides necessary hose, attachments, and accessories.

2.2 TOPSOIL:

A. Topsoil necessary to perform or complete maintenance operations, repair or replacement is to be provided by Contractor. Furnish from approved off-site source in sufficient quantity to complete all operations.

B. Prepare all topsoil used in tree and shrub pits and ground cover beds in the following proportions:

1. 2 parts by volume topsoil as specified.
2. 1 part by volume decomposed organic matter.

C. Add three (3) pounds of 12-6-6 fertilizer to each cubic yard of topsoil mix during the mixing process, for all plants.

D. Test at least three (3) samples for compliance.

E. Characteristics:

1. Fertile, friable, naturally occurring. Free of stones, clay, lumps, hardpan, roots, stumps, branches, sticks and other debris larger than two (2) inches in any dimension; free of noxious weeds, grasses, seeds, plants, extraneous matter and any substance harmful to plant growth. Topsoil from open fields will not be accepted.
2. pH: 5.0 to 7.0
3. Organic Matter: 5% to 10%
4. Sand: 50% to 70%
5. Silt: less than 30%
6. Clay: 10% to 25%
7. Permeability Rate of 5 x 10 <-3> centimeters or greater at 85% compaction.

2.3 SOIL AMENDMENTS:

A. Fertilizer:

1. Uniform in composition, dry and free flowing.
2. Commercially available.
3. Mixed per soil test report recommendations.
4. Acceptable Manufacturers:

    a. Sta-Green Plant Food Company; Nursery Special.
    b. O.M. Scott and Sons, Inc.; Scott's.
    c. W.R. Grace & Company; Peter's 20-20-20 (for deep root feeding trees).
    d. Approved substitution.

B. Lime:

1. Ground or crushed agricultural lime.
2. Containing not less than 85% of total carbonates.
3. 90% passing 20-mesh screen.
4. Not less than 50% passing a 60-mesh screen.
5. Dry and free flowing.
6. Apply at rate specified in Soil Test Report.

C. Decomposed Organic Matter:

1. Well rotted.
2. Containing no weeds, grasses or plants, their seeds, or any substance harmful to plant growth.
3. Of uniform composition.
4. Acceptable Manufacturers:

a. Klumb Company; "Soil Conditioner."
b. Approved equal.

2.4 MULCH:

A. Pine straw.

1. Free from wood, cambium, sawdust, leaves, twigs, insects, grasses or weeds, their seeds, other foreign material and any substance harmful to plant growth.

2.5 PLANT MATERIALS:

A. Plant Material:

1. Trees, shrubs and ground covers as shown and scheduled. Provide and install species, sizes and quantities shown and scheduled; standard quality, first-class representatives of each species or variety, true to name and type; nursery-grown, unless otherwise shown or scheduled.

2. Conforming to standards in American Standard for Nursery Stock.

3. Having normal, well-developed branches and vigorous root systems.

4. Complying with State and Federal laws for disease and insect infestation.

5. Healthy, vigorous, free from defects, decay, disfigurements, sun-scald injuries, abrasions of the bark, plant diseases, insect pests or eggs, borers, and all forms of infestations or objectionable disfigurements.

6. Reject plants lacking compactness or proper proportions, plants that are weak, thin or injured from too-close planting in nursery rows.

7. Plants which have been cut back from larger grades to meet certain specified requirements will be rejected.

8. Plants with undersized, dry, cracked, or broken balls, or which are loose in their balls will be rejected.

9. Balled and burlapped material: Root-pruned within last two (2) years.

10. Container-grown material: Grown for one (1) growing season in the container in which it is delivered; free from weeds and grasses. Root-bound material will be rejected.

11. Size:

a. In accordance with *American Standard for Nursery Stock*.
b. Measure plants before pruning, with branches in normal position.
c. All replacement material shall match the size attained by original materials at the time of replacement.

d. Height and spread dimensions: General body mass of plant, not from branch tip to tip.
e. Well-proportioned as to height; reject plants which meet specified measurements but do not posses an overall balance.
f. Take caliper measurement on trunk six-inches above natural ground level up to and including four-inch caliper size; twelve-inches above natural ground level for larger sizes.
g. Balled and burlapped plants shall have firm natural balls of a diameter and depth not less than per American Standard for Nursery Stock.

2.6 CHEMICAL WEED CONTROL:

A. Pre-Emergent (in bed areas):

1. Selective pre-emergent with no residual soil activity. Active ingredient: Trifluralin.
2. Commercially available.
3. Adhere to manufacturer's recommendations for strength, rate, and method of application.
4. Acceptable Manufacturers:

a. Elanco: Treflan.
b. Approved substitution.

B. Herbicide:

1. Non-selective post-emergent with no residual soil activity. Active ingredient: Isopropylamine salt of Glyphosate.
2. Commercially available.
3. Adhere to manufacturer's recommendations for strength, rate and method of application.
4. Acceptable Manufacturers:

a. Monsanto Agricultural Products Company: Round Up.
b. Approved substitution.

2.7 GUYING and STAKING:

A. Wood Stakes:

1. Pressure-treated Southern Yellow Pine or other approved wood, 2-inches x 4-inches x length specified in the Drawings, pointed at one end.
2. Aboveground portion painted black.
3. Free from insects and fungi.

B. Wire: Pliable #10 or #12 gauge galvanized steel wire, doubled and twisted.

C. Turnbuckles: As detailed and approved by Architect.

D. Protective Hose:

1. Reinforced fiber-bearing rubber hose.

2. Black.
3. May be second-hand.
4. Not less than ½-inches inside diameter.

2.8 SHRUB BED DRAINAGE:

A. Washed pea gravel for drainage fill.

B. Filter Fabric: SUPAC 5-P manufactured by Phillips Fibers Corporation, or approved substitution.

C. Corrugated perforated drainage tubing: Four-inch diameter corrugated polyethylene drainage tubing, wrapped in filter fabric.

1. Acceptable Product: ADS Drain Guard #472 manufactured by Advanced Drainage Systems, Inc.
2. Approved substitution.

SECTION 3.0 - EXECUTION

3.1 GENERAL:

A. Provide maintenance according to:

1. Guideline performance specifications herein.
2. Monthly maintenance guidelines herein.
3. Accepted horticultural practices and techniques.
4. Manufacturer's recommendations for material use.
5. Applicable State laws and local ordinances.

3.2 WATERING:

A. General Watering:

1. Water during early morning hours (2:00 am - 7:00 am).
2. Should irrigation system, or any portion of that system, fail to function, hand water until system is made functional again.
3. Do not over-water; water should never be allowed to stand in any areas for long periods of time.
4. Maintain uniform moisture in all planting areas during winter, especially when a freeze is expected.
5. Heavy clay soils hold moisture longer periods of time; sandy lighter soils drain rapidly and need to be watered more frequently.

B. Trees: Deep water all newly planted trees once every week during the summer, and the winter as necessary. This schedule should be adjusted to the amount of rain. However, unless it has rained at least ½-inches in twenty-four (24) hours, continue to deep water. Check trees monthly to determine if root ball is well drained. Take permanent corrective measures.

C. Shrubs: Water shrubs as necessary to maintain sufficient uniform moisture in bed; usually three

(3) to four (4) times weekly or more frequently if needed during the summer.

3.3 FERTILIZING:

A. Fertilize trees, shrubs and lawns per manufacturer's recommended rates in accordance with the monthly maintenance guideline herein.

B. Cultivate and water beds or pits thoroughly after application.

C. Adjust fertilizer in accordance with interim Soil Test Reports.

3.4 PRUNING:

A. Remove dead wood and sucker growth as it becomes evident.

B. Do not top or remove terminal growing point or 'leader' of any plant.

C. Review pruning practices with Architect before pruning any living portion of any plants.

D. Crape myrtles will be pruned ONLY as directed by owner’s representative.

E. Maintain height of evergreen hedges at 36”-42” height.

3.5 INSECT AND DISEASE CONTROL:

A. Maintain all plants and grass in a pest and disease-free condition by approved means.

B. Observe all applicable laws, statues, and ordinances regulating the purchase, use, application, and licensing for all pesticides.

C. Where possible, combine approved insecticide and fungicide to provide maximum protection for all plants.

D. Follow manufacturer's recommendations.

E. Observe all safety precautions.

F. Trees: Inspect for pests and diseases. Spray for insect and disease control only as infestations are noted. Control shall be specific.

G. Shrubs: If insect or disease infestation occurs, treat and continue treatment until complete eradication.

3.6 WEEDING:

A. Keep all lawn and planting areas weed free on a continuous basis by approved means.

B. Minimum weeding:

1. Two (2) applications of chemical pre-emergent spray, approved.
2. Five (5) applications (during growing season) of chemical contact spray (Round Up by Monsanto, or equal, approved).
3. One (1) day per month hand weed during the period of March 1st through September 30th; remove all visible weeds.

4. Weed to remove visible weeds during the winter.

3.7 SOD MAINTENANCE:

A. Mowing: Mow and edge lawn areas during the growing season, approximately April 1 through November 15 (year-round if overseeded with Winter Rye). Remove grass clippings from the site. Adhere to the following mowing schedule:
1. Mow and edge sod areas weekly as needed.
2. Change mowing directions to prevent rutting of grass.
3. Mowing heights: Bermuda -- 1"-1 ½"
Zoysia -- 1 ½"-2"
Fescue -- 2 ½"-3 ½"

All mowing operations are to be completed in one day.

B. Thatch Removal: Thatch removal shall occur once each year at all sod areas or as required by the Owner. Thatch shall be generally removed during early spring or mid-autumn. De-thatch using approved equipment for this purpose.

C. Core Aerating: Aeration of sod areas shall occur once each year during mid-spring or late summer using approved core aeration equipment, especially manufactured for this specific purpose. Remove cores from site.

3.8 MULCHING:

A. Keep planting areas neat and uniformly mulched to 3” depth on a continuous basis.

B. In addition to replacing and re-spreading mulch as necessary, completely replenish pine straw mulch in all planting areas twice each year in March and November.

C. Areas of dense ground cover, such as Asian jasmine do not require pine straw mulch.

3.9 STRAIGHTENING:

A. Maintain plants in their stable upright position and at the proper grade by straightening and tightening staking and guying apparatus, raising plants which have settled, and by other means.

3.10 CLEAN-UP:

A. Keep all planting areas neat, weeded and uniformly mulched on a continuous basis.

B. Clean-up adjacent walks and pavement where littered as a result of maintenance operations.

C. Remove trash and debris from surface of planting areas, whether as a result of maintenance operations or otherwise.

3.11 MONTHLY MAINTENANCE GUIDELINES:

A. January:
1. Prune trees and shrubs that have become too large or out-of-shape.
2. Inspect plants, shrubs and trees and remove any damaged or dead wood.
3. Inspect planting areas and remove any debris or litter.
4. Check staking and weather protection of first year plants.
5. Remove leaf and litter on all lawn areas weekly.
6. Mulch bed areas as needed to replenish mulch levels.
7. Spray herbicides on winter weeds around January 15th.
8. Take soil samples.
9. Transplant any trees and shrubs.
10. Replace any damaged or dead trees and shrubs.
11. Check moisture level in all planted areas and water if necessary.
12. Check drainage of planted areas, correct if excessive water persists.
13. Fertilize pansies every two weeks or as needed to maintain heavy growth and flowering. Use nitrate based fertilizer.
14. Mow lawn areas every ten days if overseeded with winter grass.

B. February
1. Prune trees and shrubs that have become too large or out-of-shape.
2. Inspect plants, trees and shrubs and remove any damaged or dead wood.
3. Inspect planted areas and remove any debris or litter.
4. Remove leaf and litter on all lawn areas weekly.
5. Apply pre-emerge herbicides to lawn to prevent crabgrass.
6. Apply pre-emerge herbicides to beds to prevent weeds.
7. Replace any damaged or dead trees or shrubs.
8. Check moisture level in all planted areas and water if necessary (weekly).
9. Protect plants susceptible to cold damage during excessive cold periods if possible.
10. Mow lawn area every ten days if overseeded with winter grasses.
11. Spot spray any existing weeds with Round-Up.
12. Establish a good edge on all bed areas.
13. Completely replace and replenish mulch in all planting areas.

C. March
1. Dethatch all lawn areas that have thatch build-up.
2. Mow and trim all lawn areas as needed.
3. Inspect plants, trees and shrubs and remove any damaged or dead wood.
4. Litter removal on all lawn areas.
5. Check moisture level in all planted areas and water if necessary (weekly).
6. Start pruning where necessary to maintain shape and form (do not shear).
7. All Liriope should be cut back to allow new growth to come out and remove winter damage to old growth.
8. Hand weed all bed areas as needed.
9. Deep-root feed all trees except pines (Peter's 20-20-20) as requested.
10. Completely replace and replenish mulch in all planting areas.

D. April
1. Fertilize all lawn areas with 32-3-12 analysis, with 50% slow release nitrogen, or equal to soil sample reports.

2. Lime lawn areas as per soil sample reports.
3. Mow and edge lawn areas weekly.
4. Fertilize shrubs, trees, groundcover area with Nursery Special by Sta-Green or equal.
5. Cultivate and weed all planted areas.
6. Inspect all planted areas and remove any dead plants and replace.
7. Inspect all plant material (shrubs and trees) and prune any dead limbs.
8. Spot spray any weed problem areas.
9. Clean up any litter on lawn.
10. Inspect all areas for insect and disease damage and treat as necessary (weekly).
11. Prepare bed areas for any annual color and plant after mid-April.
12. Remove any winter and/or early spring color after blooming.
13. Water lawns and planted areas as needed.
14. Prune shrubs after they have bloomed.
15. Inspect all plants and trees for insects and/or diseases and treat as necessary.
16. Prune hedges to keep shape and form as necessary.
17. Hand weed all bed areas as needed.
18. Apply preventive spray for lacebug and leafminer.
19. Plant annual color beds for summer.

E. May
1. Irrigate all planted and lawn areas as needed.
2. Mow and edge all lawn areas weekly.
3. Spot spray for weeds in planted and natural areas with Round-Up.
4. Weed all groundcover and bed areas as necessary.
5. Clean up litter on lawn and hard surface areas (weekly).
6. Inspect all lawn and planted areas for insects and/or disease and treat as necessary.
7. Prune shrubs and hedges as necessary to keep shape and form.
8. Apply selective herbicides for weed control particular to each variety of lawn.
9. Prune any damaged plants.

F. June
1. Irrigate all planted and lawn areas as needed.
2. Mow and edge all lawn areas weekly.
3. Trim all lawn areas as needed.
4. Spot spray for weeds in all planted areas with Round-Up.
5. Weed all groundcover and bed areas as necessary.
6. Clean up litter on all lawn areas.
7. Inspect all lawn and planted areas for insects and/or disease and treat as necessary.
8. Prune shrubs and hedges as necessary to keep shape and form.
9. Apply selective herbicides for weed control particular to each variety of lawn.
10. Fertilize lawn areas .
11. Fertilize all bed areas.
12. Hand weed all bed areas as needed.

G. July
1. Irrigate all planted and lawn areas as needed.
2. Mow and edge all lawn areas weekly.
3. Hand weed all bed areas as needed.
4. Spot spray with Round-Up on weeds in all planted areas where applicable.
5. Clean up litter on all hard surface and lawn areas weekly.

6. Inspect all lawn and plant areas for insect and/or disease and treat as necessary.
7. Prune shrubs and hedges as necessary to keep shape and form.
8. Check all bed areas for mulch replacement as needed.

H. August
1. Irrigate all planted and lawn areas as needed.
2. Mow and edge all lawn areas weekly.
3. Hand weed all bed areas as needed.
4. Spot spray with Round-Up on weeds in all planted areas where applicable.
5. Clean up litter on lawn areas weekly.
6. Inspect all lawn and plant areas for insect and/or disease and treat as necessary.
7. Prune shrubs and hedges as necessary to keep shape and form.
8. Fertilize all lawn areas in late August-early September with 8-8-25 analysis (low nitrogen).
9. Fertilize all groundcovers and bed areas.
10. Check all bed areas for mulch replacement as needed.

I. September
1. Irrigate all lawn and planted areas as necessary.
2. Mow and edge all lawn areas weekly.
3. Hand weed bed areas as needed.
4. Clean up litter on lawn areas.
5. Inspect all lawn and planted areas for insects and/or disease and treat as necessary.
6. Prune shrubs and hedges as necessary to keep shape and form.
7. Apply pre-emergent to all Bermuda or Zoysia lawns unless over seeding with Winter Rye.
8. Apply pre-emergent to all bed areas.
9. Apply lime if soil tests show pH is low on lawn areas.
10. Fertilize fall color beds.
11. Remove any summer color beds and replace with fall color.
12. Take soil test if necessary for lime and fertilizer requirements.

J. October
1. Mow and edge all lawn areas weekly.
2. Monitor water needs.
3. Clean up litter on all lawn areas.
4. Inspect all lawn and planted areas for insects and/or disease and treat as necessary.
5. Prune any damaged plants.
6. Remove leaves from all planted and lawn areas.
7. Plant pansies for winter color.
8. Replace and/or plant any new trees or shrubs.
9. Dethatch all lawn areas that have thatch build-up.

K. November
1. Clean up all litter and leaves on lawns.
2. Mow, edge and trim all lawn areas where applicable.
3. Check mulch in beds and replace where necessary after fall leaf drop. Replenish pine straw mulch.
4. Check all planted areas for water requirements.
5. Weed and cultivate beds for winter.

6. Winterize irrigation system.

L. December
1. Clean up all litter and leaves on lawns.
2. Mow, edge and trim all lawn areas where applicable.
3. Check all planted areas for water requirements.
4. Fertilize winter color beds with liquid fertilizer two times.

3.12 INSPECTION and ACCEPTANCE:

A. Monthly Review:

1. Submit a request for inspection of Maintenance Work to the Owner once a month from April through September and every two (2) months from October through March.

2. Review the previous month's work jointly with the Owner.

3. Submit a written log of fertilizer applications, and chemical insect, disease or weed control applications with each Application for Payment. This log will be a complete account of each fertilizer and chemical application performed within the month covered by that Application for Payment including date, time, weather conditions, and specific purpose and product of each application.

B. Basis of Acceptance:

1. Contractor is responsible for landscape maintenance work as specified herein and in keeping with acceptable horticultural practices.

2. During the period of the maintenance contract, replace with no additional compensation, and as soon as weather permits, all dead plant materials and all materials not in a thriving condition; replace all other workmanship and materials which are unsatisfactory in the opinion of the Owner; make good any other damage, loss, destruction or failure to flourish sufficiently as the result of inferior or defective materials or workmanship, including, but not limited to, inadequate drainage.

3. All replacement material shall match the size attained by the original material at the time of replacement.

4. Remove dead or dying material from the site within one (1) week of notice from the Owner.

5. Repair grades and other work necessitated due to planting replacements.

6. If the replacement is not acceptable during or at the end of the maintenance period, the Owner may elect either subsequent replacement or credit.

7. Responsibility for replacement or repair work applies to losses or damage other than those due to vandalism, Owner neglect, or Acts of Nature, as determined by the Owner. Acts of Nature include, but may not be limited to, high winds of hurricane or tornado force, sleet,

hail, freezing rain, and extreme cold (as determined by the Owner). Contractor agrees to replace losses due to Acts of Nature at fifteen percent (15%) less than original contract price for the damaged work.

8. The cost of mobilization (including the provisions of General Requirements and General and Supplementary Conditions) as specified herein is considered incidental to the Work and will not be counted as a separate item for payment.

3.13 FINAL INSPECTION and ACCEPTANCE:

A. At the end of the maintenance period, submit request for inspection for Final Acceptance to the Owner at least one (1) week prior to anticipated date of inspection.

B. Upon request for inspection, jointly review with Owner all Work for Final Acceptance.

C. Submit Maintenance Manual (three [3] copies) for Owner's information containing full details for care and maintenance of landscape work, personnel and procedures, and weekly schedule for maintenance.

D. Upon completion by the Contractor of all required repairs and replacements, the Owner will confirm the date of Final Acceptance of the Work.

END OF LANDSCAPE MAINTENANCE

SECTION 33 1000

WATER UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Related work specified elsewhere includes:

1. Section 31 2000 - “Earth Moving”
2. Division 22 – Plumbing

1.2 SUMMARY:

A. This Section includes water service piping system, meter, vaults, valves, and appurtenances from the existing on-site utility source of potable water to a point 5 feet outside the building, and as indicated on the Drawings, and in this Section of the Project Manual.

B. Note that the Contractor shall furnish and install connection, water meter, etc., acceptable to the utility company and call on the utility company to approve the meter and inspect the installation prior to covering.

C. All fees and charges for water service, meters, taps, permits, impact fees, etc., if any, shall be paid by the Contractor from their contract amount.

D. The extent of water service piping system, fire hydrants, etc., is indicated on the Drawings, in this Section, other referenced Sections of the Project Manual, and as otherwise required by authorities having jurisdiction.

1. All water pipe which run under roads, streets, driveways, and other vehicular paving shall be sleeved in AWWA C151 ductile iron sleeves.

E. Utility Compliance: Comply with Authority Having Jurisdiction regulations and standards pertaining to water distribution systems.

1. Where conflicts or discrepancies occur with the plans or these specifications, Authority Having Jurisdiction regulations and standards shall govern.

1.3 SUBMITTALS:

A. General: Submit the following in accordance with conditions of Contract and Division 1 Specification Sections

1. Product data for water service piping and fire protection pipe and specialties.
2. Shop drawings for water vaults, including lids.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS - GENERAL:

A. General: Pipe, valves, fittings and installation in R.O.W. and on site shall comply with requirements of this Section, other referenced Sections of the Project Manual, the Drawings, and the Authority Having Jurisdiction.

1. Pipe, fittings, hydrants and valves shall be as specified herein, subject to acceptance by the Authority Having Jurisdiction, unless other specific materials acceptable to the Authority Having Jurisdiction are indicated on the Drawings.

2. PVC piping and fittings 4" and smaller shall be C900 PVC, Class 200 plastic pipe, Schedule 40, or Type K Copper; and pipe 4" and larger, below paving and fire lines shall be ductile iron, of type(s) acceptable to the Authority Having Jurisdiction, unless other specific materials acceptable to the Authority Having Jurisdiction are indicated on the Drawings.

B. PVC Plastic, Schedule 40 PVC with pressure-rated fittings: Conform to ASTM D 1785 standard specifications for PVC plastic pipe.

C. PVC Plastic, Water Pipe: AWWA C900, Class 200. Include elastomeric seal according to ASTM F477.

1. Ductile Iron Fittings: AWWA C110, ductile-iron; or AWWA C153, ductile-iron, compact type, and specifically designed for joining PVC pipe; Include elastomeric seals according to ASTM F 477 or as otherwise required for joining plastic pipe specified

2. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended in writing by piping system manufacturer, unless otherwise indicated.

D. Where copper pipe is indicated, provide Soft Copper Tube, ASTM B 88, Type K, water tube, annealed temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

E. Ductile-Iron, Push-on-Joint Pipe: AWWA C151 and ANSI C150, C151, A21.50, and A21.15 respectively, Class 350 as approved by the Authority Having Jurisdiction, tar coated outside, with cement lining and seal coat according to AWWA C104. Include rubber compression gasket according to AWWA C111.

1. Ductile-Iron, Push-on-Joint Fittings: AWWA C110, ductile-iron; or AWWA C153, ductile-iron, compact type. Include cement-mortar lining and seal coat according to

AWWA C104 and rubber compression gaskets according to AWWA C111 (ANSI 21.11) and according to ASTM D-3139.

2. Joining Materials: AWWA C111 rubber gaskets and lubricant according to ASTM F477 requirements.

F. Ductile-Iron, Mechanical-Joint Pipe: AWWA C151, with cement-mortar lining and seal coat according to AWWA C104. Include gland, rubber gasket, and bolts and nuts according to AWWA C111.

1. Ductile-Iron, Mechanical-Joint Fittings: AWWA C110, ductile-iron; or AWWA C153, ductile-iron, compact type. Include cement-mortar lining and seal coat according to AWWA C104 and glands, rubber gaskets, and bolts and nuts according to AWWA C111.

2. Joining Materials: AWWA C111 ductile-iron or gray-iron glands, high-strength steel bolts and nuts, and rubber gaskets.

G. PE Encasement for Ductile-Iron Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch (0.20-mm) minimum thickness, tube or sheet.

H. Pipe Sleeves: Provide pipe sleeves at least one size larger than water service piping required below existing concrete and paving, and as follows.

1. Below Concrete, Entry Pads, and Paving Subject to Only Pedestrian Traffic, and for Future Irrigation: Schedule 40 PVC.

2. Below Concrete, Equipment Pads, Dumpster Pads, Valley Gutters, Curbs and Gutters, Paving Subject to Vehicular Traffic, and Where Indicated: Ductile Iron, as specified above herein this Section.

I. Identification for Underground Plastic Pipe:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allen Systems, Inc.; Reef Industries, Inc.
b. Brady (W.H.) Co.; Signmark Div.
c. Calpico, Inc.
d. Carlton Industries, Inc.
e. EMED Co., Inc.
f. Seton Name Plate Co.

2. Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid blue in color with continuously printed caption in blue letters "CAUTION - WATER LINE BURIED BELOW."

PART 3 - EXECUTION:

3.1 INSTALLATION:

A. Comply with requirements of Division 22, the International Plumbing Code, Drawings, the Authority Having Jurisdiction and requirements of other authorities having jurisdiction.

B. Comply with requirements of the State Health Department, the local Health Department, and authorities having jurisdiction.

3.2 DEPTH OF COVER:

A. Provide minimum cover of 36-inches for all water bearing piping.

3.3 INSTALLATION OF IDENTIFICATION:

A. Install continuous plastic underground warning tape during back-filling of trench for underground water service piping. Locate 6 to 8 inches below finished grade, directly over piping.

3.4 CLEANING:

A. Clean and disinfect water distribution piping as follows, or as required by utility company, Code, and authorities having jurisdiction:

1. Purge all new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired, prior to use.

2. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction or, in case a method is not prescribed by that authority, use the procedure described in AWWA C651, or as described below:

a. Fill the system or part thereof with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system or part thereof and allow to stand for 24 hours.

b. Drain the system or part thereof of the previous solution and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.

c. Following the allowed standing time, flush the system with clean, potable water until chlorine does not remain in the water coming from the system.

d. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.

B. Prepare reports for all purging and disinfecting activities, and submit for review and along with each set of “Record Documents”.

END OF WATER SERVICE PIPING

SECTION 33 3000

SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Related work specified elsewhere includes:

1. Section 31 2000 - “Earth Moving”
2. Section 03 3100 - “Concrete”
3. Division 22 - “Plumbing”

1.2 SUMMARY:

A. This Section includes sanitary sewerage system piping and appurtenances from a point 5 feet outside the building to the point of disposal.

B. The extent of sanitary sewerage system is indicated on the Drawings, in this Section 33 3000, and as otherwise required by authorities having jurisdiction.

C. All fees and charges for sanitary sewerage service, taps, connections, permits, impact fees, etc., shall be paid by the Contractor from their contract amount.

1.3 SUBMITTALS:

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

1. Product data for drainage piping and specialties.
2. Test Reports.

1.4 QUALITY ASSURANCE:

A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to sanitary sewerage systems.

B. Utility Compliance: Comply with Authority Having Jurisdiction regulations and standards pertaining to sanitary sewerage systems.

1. Where conflicts or discrepancies occur with the plans or these specifications, the Authority Having Jurisdiction regulations and standards shall govern.

C. Health Department Compliance: Comply with the State Department of Health Code or the local Health Department code, regulations and standards, whichever is more stringent.

D. Comply with requirements of authorities having jurisdiction, when more stringent than specified or otherwise indicated.

1.5 PROJECT CONDITIONS:

A. Site Information: Perform site survey, research public utility records, and verify existing utility locations. Verify that sanitary sewerage system piping may be installed in compliance with original design and referenced standards.

1.6 SEQUENCING AND SCHEDULING:

A. Coordinate any connection to public sewer with the Authority Having Jurisdiction.

B. Coordinate with interior building sanitary drainage piping.

C. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cleanouts:
   a. Ancon, Inc.
   b. Josam Co.
   c. Smith (Jay R.) Mfg. Co.
   d. Wade Div.; Tyler Pipe.
   e. Zurn Industries, Inc.; Hydromechanics Div.

2. Underground Warning Tapes:
   a. Allen Systems, Inc.; Reef Industries, Inc.
   b. Brady (W.H.) Co.; Signmark Div.
   c. Calpico, Inc.
   d. Carlton Industries, Inc.
   e. EMED Co., Inc.
   f. Seton Name Plate Co.

2.2 PIPE AND FITTINGS:

A. Ductile-Iron, Gravity Sewer Pipe and Fittings:

1. Pipe: Ductile iron pipe meeting AWWA C-150, C-151 and ANSI A21-50 and A 21.15 for coated outside and cement lined inside. Cement lining according to AWWA C104, Class 350.

2. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.
3. Compact Fittings: AWWA C153, for push-on joints.
4. Gaskets: AWWA C111, rubber.

B. PE Encasement for Ductile-Iron Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch (0.20-mm) minimum thickness, tube or sheet.

C. Identification for Underground Plastic Pipe:

1. Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid yellow in color with continuously printed caption in red letters "CAUTION - SANITARY SEWER LINE BURIED BELOW."

2.3 CLEANOUTS:

A. General: Provide Mission adjustable repair coupling (or approved equal) with stainless steel bends and stainless-steel shear ring and a Zurn #ZN1400HD-3, Smith 4220 (or approved equal) cover set flush in a minimum 14" square concrete slab.

2.4 IDENTIFICATION:

A. Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid green in color with continuously printed caption in black letters "CAUTION - SEWER LINE BURIED BELOW."

PART 3 - EXECUTION

3.1 PREPARATION OF FOUNDATION FOR BURIED SANITARY SEWERAGE SYSTEMS:

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid, and backfill according to provisions in Section 31 2000 – Earth Moving.

C. Shape bottom of trench to fit bottom of pipe. Fill unevenness with tamped sand backfill. Dig bell holes at each pipe joint to relieve the bells of all loads and to ensure continuous bearing of the pipe barrel on the foundation.

3.2 PIPE APPLICATIONS FOR UNDERGROUND SANITARY SEWERS:

A. Refer to Paragraph 2.2 above.

3.3 INSTALLATION, GENERAL:

A. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of the underground sanitary sewerage system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

C. Use fittings for changes in direction. Use fittings for branch connections, except where direct tap into existing sewer is indicated.

D. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

E. Install piping pitched down in direction of flow, at minimum slope of 1 percent, except where indicated otherwise.

F. Extend sanitary sewerage system piping to connect to building sanitary drains, of sizes and in locations indicated.

G. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed, by tunneling, jacking, or a combination of both.

3.4 PIPE JOINT CONSTRUCTION AND INSTALLATION:

A. Join and install ductile iron pipe per ALDOT Standard Specifications.

3.5 CLEANOUTS:

A. Install cleanouts and extension from sewer pipe to cleanout at grade as indicated. Set cleanout lid in concrete block 14 by 14 by 12 inches deep, except where location is in concrete paving. Set top of cleanout 1 inch above surrounding earth grade or flush with grade when installed in paving.

3.6 TAP CONNECTIONS:

A. Make connections to existing piping and underground structures so that finished work will conform as nearly as practicable to the requirements specified for new work.

B. When tapping into existing man holes, use flexible rubber boot in accordance with authority having jurisdiction's requirements.

C. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap, with not less than 6 inches of 3000-psi 28-day compressive-strength concrete.

D. Make branch connections from side into existing 4- to 21-inch piping by removing section of existing pipe and installing wye fitting, into existing piping. Encase entire wye with not less than 6 inches of 3000-psi 28-day compressive-strength concrete.

1. Provide concrete that will attain minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
2. Use epoxy bonding compound as interface between new and existing concrete and piping materials.

E. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris, concrete, or other extraneous material that may accumulate.

3.7 INSTALLATION OF IDENTIFICATION:

A. Install continuous plastic underground warning tape during back-filling of trench for underground water service piping. Locate 6 to 8 inches below finished grade, directly over piping.

3.8 FIELD QUALITY CONTROL:

A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction.

B. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.
2. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.
3. Flush piping between manholes, if required by local authority, to remove collected debris.

C. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.

1. Make inspections after pipe between manholes and manhole locations has been installed and approximately 2 feet of backfill is in place, and again at completion of project.
2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects correct such defects, and reinspect.

END OF SANITARY SEWERAGE UTILITIES

SECTION 33 4001

STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Related work specified elsewhere includes:

.. Section 31 2000 - "Earth Moving"
.. Section 03 3000 - "Cast-In-Place Concrete"

1.2 DESCRIPTION OF WORK:

A. Work described in this section includes the construction of new storm drainage pipe and structures as shown on the Drawings

1.3 QUALITY CONTROL:

A. Certifications: The Contractor shall submit to the Architect copies of certificates from suppliers of pipe, gaskets, reinforcing steel, cast iron downspout boots, cast iron frames, covers and grates, ready-mix concrete and other manufactured items, certifying that these products comply with the specifications and standards listed hereinafter.

B. Standard Specifications: Unless otherwise noted, all specifications referred to shall be the Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction, 2014 Edition or most current edition.

C. Testing: All laboratory and field testing as required to ensure compliance with these specifications will be performed by an independent testing laboratory.

D. Comply with requirements of the International Plumbing Code, the American Concrete Pipe Association, and authorities having jurisdiction, when more stringent than specified or otherwise indicated

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Where indicated, pipe smaller than 12-inches in diameter shall be Schedule 80 PVC, Contech A2000 PVC (or approved equal), or ADS N-12 HP HDPE, unless otherwise indicated on the drawings.

1. Where indicated on the Drawings for "french drain" or "perforated underdrain", pipe shall be equivalent to ADS N-12 (perforated) corrugated HDPE pipe with smooth interior or perforated Contech A2000 PVC, complete with filter fabric "sock" and all required or necessary system accessories, fittings, and components, as specified in Article 853.13.

B. Pipe larger than 12-inches (or equivalent area in arch pipe) shall be Class 3, minimum reinforced concrete pipe (RCP) as specified in Article 850, or as indicated on the Drawings.

C. Concrete and reinforcing steel for headwalls, inlets, manholes, and other storm drainage structures shall comply with Alabama Department of Transportation Specification Section 501, and Section 502. Concrete shall be Class "A", Type 2 (3,000 psi).

D. Masonry materials and precast concrete units shall conform to Article 621.02.

E. Castings for frames, covers and grates in drainage structures shall comply with ALDOT Section 836, with particular attention directed to ALDOT Article 836.04, 836.05, 836.06, and 836.07.

1. All manhole covers shall be round.

F. Identification for Underground Plastic Pipe:

1. Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid yellow in color with continuously printed caption in black letters "CAUTION – STORM SEWER LINE BURIED BELOW."

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allen Systems, Inc.; Reef Industries, Inc.
b. Brady (W.H.) Co.; Signmark Div.
c. Calpico, Inc.
d. Carlton Industries, Inc.
e. EMED Co., Inc.
f. Seton Name Plate Co.

PART 3 - EXECUTION

3.1 STORM DRAIN PIPE:

A. Construction requirements, including excavation of trench, placing pipe, and backfilling around pipe shall conform to the applicable portions of Article 530.03 of the Alabama Department of Transportation specifications.

B. Bedding for storm pipe shall be as shown on the Drawings and as per the pipe manufacturer's requirements, Type 3 or better installation. Open graded stone, such as #57 stone, is not allowed as backfill.

C. Compaction requirements for backfill shall be the same as specified for type of surface constructed over the trench, paved or planted areas as described in Section 31 2000 - "Earth Moving."

D. Properly coordinate with elevations of grades, footings, other below grade work, and etc.

3.2 INSTALLATION OF IDENTIFICATION:

A. Install continuous plastic underground warning tape during back-filling of trench for underground water service piping. Locate 6 to 8 inches below finished grade, directly over piping.

3.3 STRUCTURES:

A. Inlets, manholes, cleanouts and other storm drainage structures shall be installed or constructed in accordance with applicable portions of the following sections of the Alabama Highway Department Standard Specifications:

1. Section 501 - Structural Portland Cement Concrete.
2. Section 502 - Steel Reinforcement.
3. Section 613 - Brick and Concrete Block Masonry.
4. Section 620 - Minor Structure Concrete.
5. Section 621 - Inlets, Junction Boxes, Manholes and Miscellaneous Drainage Structures.
6. Section 622 - Resetting Gratings and Covers and for Catch Basins, Inlets, and Manholes.

END OF STORM DRAINAGE

Alabama Department of Human Resources
DHR – Houston County

DOTHAN, HOUSTON COUNTY, ALABAMA

September 9, 2025

REPORT OF GEOTECHNICAL EXPLORATION

Prepared By

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September 9, 2025

Ms. Jacquelyn Hart, AIA
Goodwyn Mills Cawood, LLC
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Birmingham, Alabama 35233

RE: REPORT OF GEOTECHNICAL EXPLORATION
ALABAMA DEPARTMENT OF HUMAN RESOURCES
DHR – HOUSTON COUNTY
DOTHAN, HOUSTON COUNTY, ALABAMA
GMC PROJECT NO. GMGM250037

Dear Ms. Hart,

Goodwyn Mills Cawood, LLC (Geotechnical & Construction Services Division) is pleased to provide this report of geotechnical exploration performed for the above referenced project. This report includes the results of field and laboratory testing and general recommendations for foundation design and sitework.

We appreciate the opportunity to perform this study during this phase of the project for you and look forward to continued participation during the construction phase of this project. If you have any questions pertaining to this report, or if we may be of further service, please do not hesitate to call.

Sincerely,
GOODWYN MILLS CAWOOD, LLC

David D. Gamlin, PE
Project Engineer
Licensed Alabama 51465

Michael J. McNeill, PE
Vice President
Licensed Alabama 26331



GMC

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Subsurface Diagrams
Boring Records
Summary of Laboratory Results
Field and Laboratory Procedures

1.0 EXECUTIVE SUMMARY

A geotechnical exploration has been conducted for the proposed Alabama Department of Human Resources (DHR) Office Building to be located on Prevatt Road in Dothan, Houston County, Alabama. The proposed site is currently adjacent (east) to the existing DHR Office Building which is located at the southwest corner of U.S. 431 and Prevatt Road.

We have been provided with a preliminary site outline; however, detailed grading and structural information have not been provided at the time of this report. The site has been previously developed and is relatively level. We understand that the proposed office building will be approximately 45,000 square feet. We anticipate future building and parking grades to be within approximately 5 feet of current site elevations. Likewise, we have assumed maximum column and wall loads of 150 kips and 4 kips/foot, respectively, and construction will be masonry (CMU) type with steel joists.

- A total of seventeen (17) soil test borings were drilled at the site. Six (6) borings were drilled in the proposed building footprint to a depth of 20 feet each. Eleven (11) borings were drilled in the planned parking and drive areas to a depth of 10 feet each.
- The borings initially encountered 4 to 9 inches of organic-laden material (topsoil) across the site.
- The borings predominantly encountered approximately 2 to 3 feet of existing fill material generally classified very loose to medium silty sand (SM). Standard Penetration Test (SPT) N-Values in these materials ranged from 0 to 10 blows per foot (bpf).
- Below the existing fill materials, the borings typically encountered varying layers of very loose to dense clayey sand (SC) and very soft to hard sandy lean clay (CL) to the boring termination depths. The borings generally encountered soils with more clay and higher consistency with increasing depth below the surface. SPT N-Values in these materials ranged from 2 to 35 bpf.
- Groundwater was not encountered at the time of drilling.
- The site should be suitable for development, provided it is prepared herein. The main development issue for this site will be the low consistency soils (SPT N-values ‹ 8 bpf) and existing fill in the upper 4 to 6 feet of the existing subgrade elevation.
- **We recommend an allowance for the removal and replacement of approximately 4 feet of unsuitable materials within the building footprint and 2 feet within the pavement areas be included in the bid documents.** The undercut area should extend ten (10) feet beyond the building and five (5) feet beyond the parking areas.
- An additional option of geotextile and stone should also be considered and budgeted as well, if pavement areas require further stabilization beyond the upper two (2) feet.
- We recommend that conventional shallow foundations should be sized for a maximum allowable bearing capacity of 2,000 pounds per square foot (psf). The foundations should bear at a minimum depth of 18 inches below the proposed final exterior grade in the medium to stiff naturally occurring soils or newly placed compacted fill material.

The following sections provide additional detailed recommendations. The recommendations presented herein have been developed on the basis of the subsurface conditions encountered during field investigation and our understanding of the proposed construction. Should changes in the project criteria occur, a review must be carried out by GMC to determine if modifications to our recommendations will be required.

2.0 PROJECT INFORMATION AND SCOPE OF WORK

2.1 Project Information

A geotechnical exploration has been conducted for the proposed Alabama Department of Human Resources (DHR) Office Building to be located on Prevatt Road in Dothan, Houston County, Alabama. The proposed site is currently adjacent (east) to the existing DHR Office Building which is located at the southwest corner of U.S. 431 and Prevatt Road.

We have been provided with a preliminary site outline; however, detailed grading and structural information have not been provided at the time of this report. The site has been previously developed and is relatively level. We understand that the proposed office building will be approximately 45,000 square feet. We anticipate future building and parking grades to be within approximately 5 feet of current site elevations. Likewise, we have assumed maximum column and wall loads of 150 kips and 4 kips/foot, respectively, and construction will be masonry (CMU) type with steel joists.

2.2 Scope of Work

The purpose of this exploration was to perform a general evaluation of the subsurface soil conditions at the site and to provide general sitework, pavement, and foundation recommendations. The scope of the exploration and evaluation included drilling a total of seventeen (17) soil test borings. Six (6) borings were drilled in the proposed building footprint to a depth of 20 feet each. Eleven (11) borings were drilled in the planned parking areas to a depth of 10 feet each. It also included an engineering evaluation of the materials encountered.

The scope of services for the geotechnical study did not include any environmental assessment for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site. Any statements in this report or on the boring records regarding odors, colors, or unusual or suspicious items or conditions are strictly for the information of the client.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

3.1 Field Exploration

The boring locations and depths were selected by GMC personnel. Field testing employed by GMC was performed in general accordance with ASTM standards or generally accepted methods. The borings were located in the field by GMC personnel.

The borings were performed on August 13, 2025 using a Geoprobe 7822 drill rig equipped with a rotary head and hollow stem augers (HSA). Soils were sampled using a two-inch OD split barrel sampler in accordance with ASTM D1586 driven with an automatic hammer.

3.2 Laboratory Testing

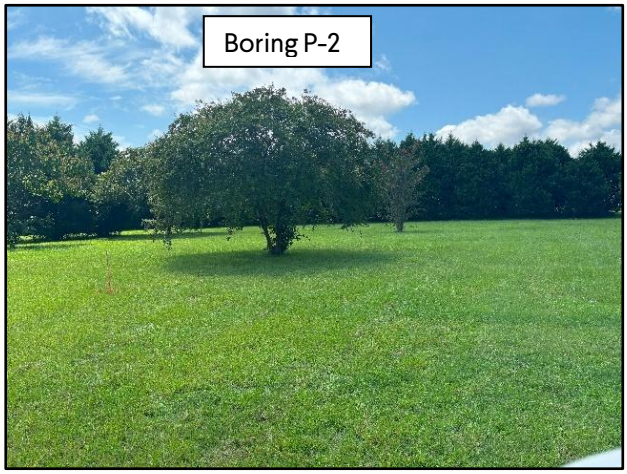
The laboratory testing program included visual classification of all soil samples and laboratory tests consisting of natural moisture contents, grain size analyses, and Atterberg limits tests. The laboratory testing program was conducted in accordance with applicable ASTM Standards, and the results are indicated on the Boring Records and summarized in the Appendix.

4.0 SITE AND SUBSURFACE CONDITIONS

4.1 General

At the time of this study, the proposed site was located on the south side of Prevatt Road approximately 700 feet east of its intersection with U.S. 431. The site currently includes a residential house with typical landscaping as well as other landscaped areas including short grasses and trees/bushes. The site slopes gently downward from the northwest corner to the southeast corner. Current topographic maps indicate site elevations range from EL 332 feet (SE Corner) to EL 345 feet (NW Corner). The photos below show the site at the time of our investigation.





4.2 Site Geology

Published geologic information indicates that the site is underlain by Residuum consisting of the Claiborne/Jackson Group of the Eocene-Oligocene Age. The primary constituency of this formation is clay or mud, with others consisting of sand, limestone, and chert. White to moderate-reddish-orange locally mottled sandy clay and residual clay with scattered layers of gravelly medium to coarse sand, fossiliferous chert and limestone boulders and limonitic sand masses are observed.

4.3 Subsurface Conditions

Surficial Materials
The borings initially encountered 4 to 9 inches of organic laden material (topsoil) across the site.

Existing Fill Materials
The borings predominantly encountered approximately 2 to 3 feet of existing fill material generally classified very loose to medium silty sand (SM). Standard Penetration Test (SPT) N-Values in these materials ranged from 0 to 10 blows per foot (bpf). It is likely that this material was placed during the original construction and grading of the existing residential house lot.

Residual Materials
Below the existing fill materials, the borings typically encountered varying layers of very loose to dense clayey sand (SC) and very soft to hard sandy lean clay (CL) to the boring termination depths. The borings generally

encountered soils with more clay and higher consistency with increasing depth below the surface. SPT N-Values in these materials ranged from 2 to 35 bpf. Auger refusal was not encountered in the borings.

The subsurface descriptions contained herein are of a generalized nature to highlight the major soil stratification features and soil characteristics. The boring records included in the Appendix should be reviewed for specific information as to individual boring location. The stratification shown on the boring records represents conditions only at the actual boring location. Variations may occur and should be expected across the site. The stratifications represent the approximate boundary between subsurface materials, and the transition may be gradual.

4.4 Groundwater Information

Groundwater was not encountered in the borings at the time of drilling. The borings were backfilled prior to leaving the site for safety reasons and therefore no long-term groundwater levels were recorded. It is important to note that the groundwater levels may not have stabilized in the borings. Furthermore, groundwater levels may vary due to seasonal conditions and recent rainfall.

5.0 SITEWORK RECOMMENDATIONS

5.1 General

The site should be suitable for development, provided it is prepared herein. The main development issue for this site will be the low consistency soils (SPT N-values ‹ 8 bpf) and existing fill in the upper 4 to 6 feet of the site. These soils should be remediated by removal and either replacement or recompaction to provide a suitable subgrade for foundations, slab support, and pavements.

5.2 Sitework Recommendations

Clearing and Stripping

Sitework should begin with clearing and grubbing of the site and should include the removal of the organic laden material, deleterious material, and asphalt pavement. All existing underground utilities and foundations to be abandoned in the planned construction areas should be removed and properly backfilled with structural fill material. We recommend a minimum of 10-inches of stripping be budgeted for this site.

Low Consistency Soils

The borings encountered existing fill materials and residual soils consisting of very loose to loose clayey and silty sands (SC and SM) and very soft to soft sandy lean clay (CL) in the upper 4 to 6 feet of the site. These soils, if left in place, could result in settlement of foundations and pavements above generally acceptable tolerable limits.

If foundations or pavements are to be located in these materials, we recommend these soils be evaluated and remediated to provide a stable bearing surface. Loose or soft soils may be moisture conditioned and compacted per Section 5.5 of this report or undercut to suitable material. All subgrade soils should be evaluated by a geotechnical engineer or his representative to determine suitability prior to fill placement or building construction. **We recommend an allowance for the removal and replacement of approximately 4 feet of unsuitable materials within the building footprint and 2 feet within the pavement areas be included in the bid documents.** The undercut area should extend ten (10) feet in the building and five (5) feet beyond the parking

areas. Prior to undercutting, the site should be stripped and cut to the subgrade elevation, compacted, and proofrolled as noted below.

Undercut soils may be stockpiled and re-used as structural fill material, if they are free of deleterious materials and meet the specifications of Section 5.5 of this report. We anticipate that these soils will require moisture conditioning to be able to be reused. Additional testing of these soils would be required.

Proofrolling

Once the site is at grade and prior to the placement of any new fill, the areas should be proofrolled with repeated passes of a loaded tandem axle dump truck to locate deeper soft soils. Soils that are observed to rut or deflect excessively under the moving load should be undercut and replaced with properly compacted fill. The proofrolling, undercutting, and filling activities should be witnessed by a qualified representative of the geotechnical engineer and should be performed during a period of dry weather.

We anticipate that recompaction of the surface soils will be required. Attempts can first be made to compact the problem soils. If dry weather conditions exist prior to and at the time of construction, re-compaction and densification may prove successful. The soils should be scarified and the soil moisture should be adjusted to within 3 percent of optimum moisture for low plasticity soils. Once proof rolling has been accomplished, then re-compaction of the soils may be attempted. In pavement areas where unsuitable soils are encountered, stabilization using geotextile or geogrid with stone may be a more economical option than removal and replacement of the soils.

5.3 Time of Year Site Preparation Considerations

The time of the year that the sitework begins can affect the project considerably. In this area, the "wet" season is generally between the months of November to April, and the "dry" season from May to October. There are many considerations that need to be addressed prior to bidding a project that could affect the budget based on the time of year a project starts earthwork activities. The time of the year that the geotechnical borings were performed can provide a false sense of actual near surface conditions depending on the time of year and weather conditions. Below are considerations that should be addressed based on the time of the year earthwork is started.

"Wet" Season

During the "wet" season, the amount of undercutting may be greater, therefore resulting in greater excavation costs. The soils are typically proofrolled to determine their suitability for the placement of new fill or subgrade support. During the wet season, the surface soils have a higher moisture content and will tend to pump, therefore, hindering the placement of new fill. In addition, the drying time, time period between rain events, and temperature is not conducive to scarify soils, allow to dry, and recompact. At this time, the decision should be made by the owner to try either scarify/dry/compact the in-place soils, which could take time, or undercut and replace with suitable material, which could increase the sitework costs. Based on our experience, the amount of undercut could be an additional 1 to 2 feet (or greater in localized areas), whereas in drier weather, lesser amounts of undercutting may be necessary, if recompaction or stabilization of soils left in place can be achieved.

Some undercut soils are not always "unsuitable" soil and can be moisture conditioned and reused as fill in the deep areas if drying conditions are favorable.

"Dry" Season

During the "dry" season, the surface soils have a lower moisture content and will tend to "bridge" or "crust" softer underlying soils. They will generally allow the placement of new fill, but the crust can break down if repeated passes with heavily loaded equipment is persistent. In addition, new fill from cuts or other sources may need to be moisture conditioned prior to compaction. The soils can dry significantly, requiring the addition of water for proper compaction. Water trucks should be used, as necessary, by the contractor to condition the soils within the required specifications.

Contractor Responsibility

The grading contractors have the option of performing their own evaluation of the site conditions to assess the excavation considerations based on the time of year a project is bid. We strongly suggest that the grading contractors conduct their own exploration and evaluation of the site conditions and material management requirements to cost effectively develop the site.

Typically, due to the movement of heavy equipment and weather conditions, the subgrade becomes disturbed during construction. As a result, fine grained clayey soils tend to lose shear strength and support capability. Therefore, additional effort on the Contractor's part will be required to reduce traffic and limit disturbance of soils. It is essential that the subgrade be restored to a properly compacted condition based on optimum moisture and density requirements. Restoration of the subgrade should be addressed in the project specifications.

5.4 Drainage Considerations

Adequate drainage should be provided at the site to reduce the increase in moisture content of the foundation soils. We recommend that the parking lots, walkways, and the ground surface be sloped away from the structure on all sides. Roof drainage should be collected by gutters and downspouts and transmitted by pipe to the storm water drainage system or discharge a minimum of 5 feet away from the building.

5.5 Fill Placement

Soil Fill Material

Soil fill material should be placed in loose lifts not exceeding 8-inches in thickness with a maximum particle size of 3 inches. The following table summarizes the compacted fill requirements:

Location	Test Method	Compaction Required (minimum)	Moisture Content
Structural Areas and 10' beyond perimeter	ASTM D698 (standard)	98 %	-/+3 percentage points of optimum moisture
Parking and Drive Areas and 5' beyond the curb	ASTM D698 (standard)	98 %	-/+3 percentage points of optimum moisture

Structural fill material should meet the following characteristics:

Property	Requirement
Organic Material	≤ 5%
Liquid Limit	‹ 50%
Plasticity Index	≤ 25%
Maximum Dry Density	≥ 100 lb/ft^3
Maximum Particle Size	3 inches or less

Samples of the proposed fill materials, either from on-site or borrow, should be provided to the geotechnical engineer for Proctor testing and evaluation prior to placement. The on-site soils (classified as SC and CL) should be suitable for reuse as structural fill material but may need to be moisture conditioned. Density tests should be performed to document compaction and moisture content of any earthwork involving soils and other applicable materials. Density tests should be performed frequently, with a recommended minimum of one test per 5,000 square feet per lift of fill in structural areas and one test per 10,000 square feet per lift in other areas. Fill material must meet the specified density and moisture requirements to be considered acceptable.

5.6 Backfilling of Utility Trenches

Backfilling of storm drain and utility trenches must be performed in a controlled manner to reduce settlement of the fill and cracking of overlying floor slabs and pavements. We recommend that utility trenches be backfilled with acceptable borrow or dense-graded crushed stone in 6-inch loose lifts compacted with mechanical piston tampers to the project requirements. Should seepage occur in utility trenches, it may be necessary to "floor" the trench with dense-graded gravel to provide a working surface. If crushed stone is used to backfill utility trenches, we recommend that dense graded aggregate (DGA, compacted in lifts) be used. Open-graded crushed stone, such as ALDOT #57, can serve as a channel for seepage toward structures and therefore is not recommended for use as utility trench backfill within 5 feet of the building's exterior perimeter and under pavements and drives.

5.7 Subgrade Restoration

Typically, due to the movement of heavy equipment and weather conditions, the subgrade soil becomes disturbed during construction. As a result, these soils tend to lose shear strength and support capability. Therefore, additional effort on the contractor's part will be required to reduce traffic and limit disturbance of soils. It is essential that the subgrade be restored to a properly compacted condition based on optimum moisture and density.

6.0 STRUCTURAL RECOMMENDATIONS

6.1 Shallow Foundations

If the site is prepared as above, column and wall foundations can be supported on shallow foundations. We recommend that conventional shallow foundations should be sized for a maximum allowable bearing capacity of 2,000 pounds per square foot (psf). The foundations should bear at a minimum depth of 18 inches below the proposed final exterior grade in the medium to stiff naturally occurring soils or newly placed compacted fill material. Based on the assumed building loads we anticipate post-construction settlements of 1-inch for total and ½-inch for differential settlement over a distance of 50 feet.

Even though computed footing dimensions may be less, column footings and continuous footings should have minimum width dimensions of 24 inches and 18 inches, respectively. This allows for hand cleaning of materials disturbed during the excavation process and reduces the potential for punching shear failure.

Foundation concrete should be placed the same day as footings are excavated so that the foundation bearing soils can remain near the existing moisture content. Foundation bearing surfaces should not be disturbed or left exposed during inclement weather. Saturation of the on-site soils can cause a loss of strength and increased compressibility. If bearing soils dry excessively, the can later well and heave foundations. Excavations for footings should be hand cleaned to remove loose soil or mud and the bearing surface should be thoroughly compacted. If concrete placement is not possible immediately after excavation, we recommend that a thin layer (approximately 2 inches) of lean concrete or CLSM be placed on the bearing surface for protection after we have observed and evaluated the exposed bearing surfaces.

All foundation excavations should be observed by the geotechnical engineer or his representative. The engineer can provide geotechnical guidance to the owner's design team should any unforeseen foundation problems develop during construction. If areas of foundation surfaces prove to be unsuitable, the foundation may need to be over-excavated. The over-excavated area can be backfilled with "lean" concrete, controlled low strength material (CLSM), or well-compacted dense graded crushed stone (ALDOT 825B) up to the planned foundation bearing depth.

6.2 Floor Slabs

It is our opinion that floor slabs can be built on-grade achieving support from properly compacted fill material or approved existing subgrade. For select fill subgrade soils compacted to at least 98 percent of the materials standard Proctor maximum dry density, we recommend a modulus of subgrade reaction of 125 psi/in (pci). Ground supported slabs should be founded on a minimum of 4 inches of compacted, granular materials such as crushed stone or a clean sand with less than 10% passing the #200 sieve. This layer should provide uniform and immediate support of the slab and act as a capillary break. A vapor retarder should be used on top of the granular layer, as required by the building use.

Care should be taken so that fines from the subgrade are not allowed to contaminate the granular layer. If fines do contaminate this layer, capillary rise and subsequent damage to moisture sensitive floor coverings could occur. On most projects, there is some time lag between initial grading and the time when the contractor is ready to place concrete for the slab-on-grade. Inclement weather just prior to placement of concrete for the slab-on-grade can result in trapped water in the granular layer.

6.3 Seismic Site Classification

Subsurface information (SPT and soil classification) from the borings, published geologic information, and our experience was used to estimate the seismic site classification according to methods in the 2021 International Building Code. Based upon this information, we recommend a Seismic Class of **D (Stiff Soil)** for this site. The design responses for the short 0.2-sec (S_{DS}) and 1-second period (S_{D1}) are included in the following table. The responses are modeled on the ASCE Hazard Tool (https://ascehazardtool.org) for the site located at approximate Latitude 31.195011 and an approximate Longitude -85.370993. Based on our understanding of the project, we have assumed a Rick Category of **III**. If the Risk Category is different, the values below may need to be revised.

Period (sec)	Mapped Spectral Response Accelerations (g)		Values of Site Coefficient for Site Class		Maximum Spectral Response Acceleration Adjusted for Site Class (g)		Design Spectral Response Acceleration (g)	
0.2	S_S	0.082	F_a	1.6	S_{MS}	0.132	S_{DS}	0.088
1.0	S_1	0.058	F_v	2.4	S_{M1}	0.139	S_{D1}	0.093

Reference: ASCE Hazard Tool (https://ascehazardtool.org)

7.0 PAVEMENTS

7.1 General

We have not been provided with traffic information at the time of this report; however, based on similar projects of this type, we assume that typical traffic will include passenger vehicles and occasional delivery and garbage trucks. If this traffic information changes, it should be provided to us for review and, if necessary, to make changes to pavement recommendations and sections herein.

Based on the existing site conditions and planned use, we recommend that a flexible pavement be utilized in the parking and drive lanes and a rigid pavement in the area of the dumpster pad and any loading areas.

7.2 Subgrade

The pavement subgrades should be thoroughly proofrolled prior to fine grading to identify loose or soft soils not encountered during the mass grading of the site. Any loose or soft areas should be remediated as outlined in Section 5.0 of this report. **Undercut of loose/soft materials and either recompaction or replacement with structural fill should be budgeted for the 2 feet underlying the pavements per Section 5.2 of this report. If pavement areas require further stabilization, an additional option of geotextile and stone should also be considered and budgeted as well.**

Typically, during construction, the pavement subgrade becomes disturbed because of traffic and environmental conditions. Prior to construction of pavements, it is essential that the subgrade be restored to a properly compacted condition. The specifications should include notes pertaining to subgrade restoration immediately prior to pavement construction. The on-site clayey soils will tend to lose shear strength (and consequently pavement support capability) if they are exposed to excessive moisture. Thus, proper moisture conditioning of the subgrade prior to placement of the pavement base course will result in better pavement performance.

7.3 Rigid Pavement

All Portland cement concrete pavements should contain 4 to 6 percent entrained air assuming the mix will contain ¾ -inch to 1-inch nominal maximum size aggregate. The concrete slump should be no more than 2 inches when placed by slip forming and no more than 4 inches for non-slip formed concrete. Minimum 28-day concrete compressive strength should be 4,000 psi and minimum flexural strength 650 psi.

Pavement Area	Minimum Section Thickness	Pavement Materials
Standard Duty Pavements	5.0 inches	ALDOT Section 450A Concrete Pavement
	4.0 inches (1)	ALDOT Section 825 Type B, Dense Graded Aggregate Base (100% Modified)
Heavy Duty Pavements	6.0 inches	ALDOT Section 424A Superpave Bituminous Wearing Surface
	4.0 inches (1)	ALDOT Section 825 Type B, Dense Graded Aggregate Base (100% Modified)

(1) In lieu of crushed aggregate base course (ALDOT 825 Type B), soil aggregate base course (ALDOT 823 Type B or C) can be utilized with a thickness of 8 inches for Standard Duty and Heavy Duty pavement sections.

Pavement joints, reinforcing, and details should be designed in accordance with the applicable American Concrete Institute (ACI) standards. Portland cement concrete pavement should meet the requirements of ALDOT Section 450.

7.4 Flexible Pavement

The typical minimum flexible pavement sections should include the following:

Pavement Area	Minimum Section Thickness	Pavement Materials
Standard Duty Pavements	1.0 inch	ALDOT Section 424A Superpave Bituminous Wearing Surface
	2.0 inches	ALDOT Section 424B Superpave Bituminous Binder Layer
	6.0 inches (1)	ALDOT Section 825 Type B, Dense Graded Aggregate Base (100% Modified)
Heavy Duty Pavements	1.5 inches	ALDOT Section 424A Superpave Bituminous Wearing Surface
	3.0 inches	ALDOT Section 424B Superpave Bituminous Binder Layer
	6.0 inches (1)	ALDOT Section 825 Type B, Dense Graded Aggregate Base (100% Modified)

(1) In lieu of crushed aggregate base course (ALDOT 825 Type B), soil aggregate base course (ALDOT 823 Type B or C) can be utilized with a thickness of 9 inches for Standard Duty and Heavy Duty pavement sections.

A prime coat (ALDOT Section 401) should be placed on the dense graded aggregate prior to bituminous binder layer placement. A tack coat (ALDOT Section 405) should be placed between bituminous pavement layers. The pavement sections represent the minimum recommended thickness for a pavement section designed for a 20-year life. However, periodic maintenance should be anticipated over the pavement design life. All pavement materials and construction procedures should conform to the *State of Alabama Department of Transportation Standard Specifications for Highway Construction, Latest Edition*. The hot-mix asphalt should conform to Section 424.

8.0 REPORT LIMITATIONS

The recommendations submitted are based on the available soil information obtained by GMC and design details furnished by GMC for the proposed project. Additional borings should be drilled at the site to help characterize the subsurface conditions. In addition, building and loading condition specific geotechnical explorations should be performed for individual building sites so that site-specific recommendations can be provided.

The recommendations submitted are based on the available soil information obtained by GMC and design details furnished by GMC for the proposed project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, we should be notified immediately to determine if changes in the foundation, or other, recommendations are required. If GMC is not retained to perform these functions, GMC cannot be responsible for the impact of those conditions on the performance of the project.

The findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

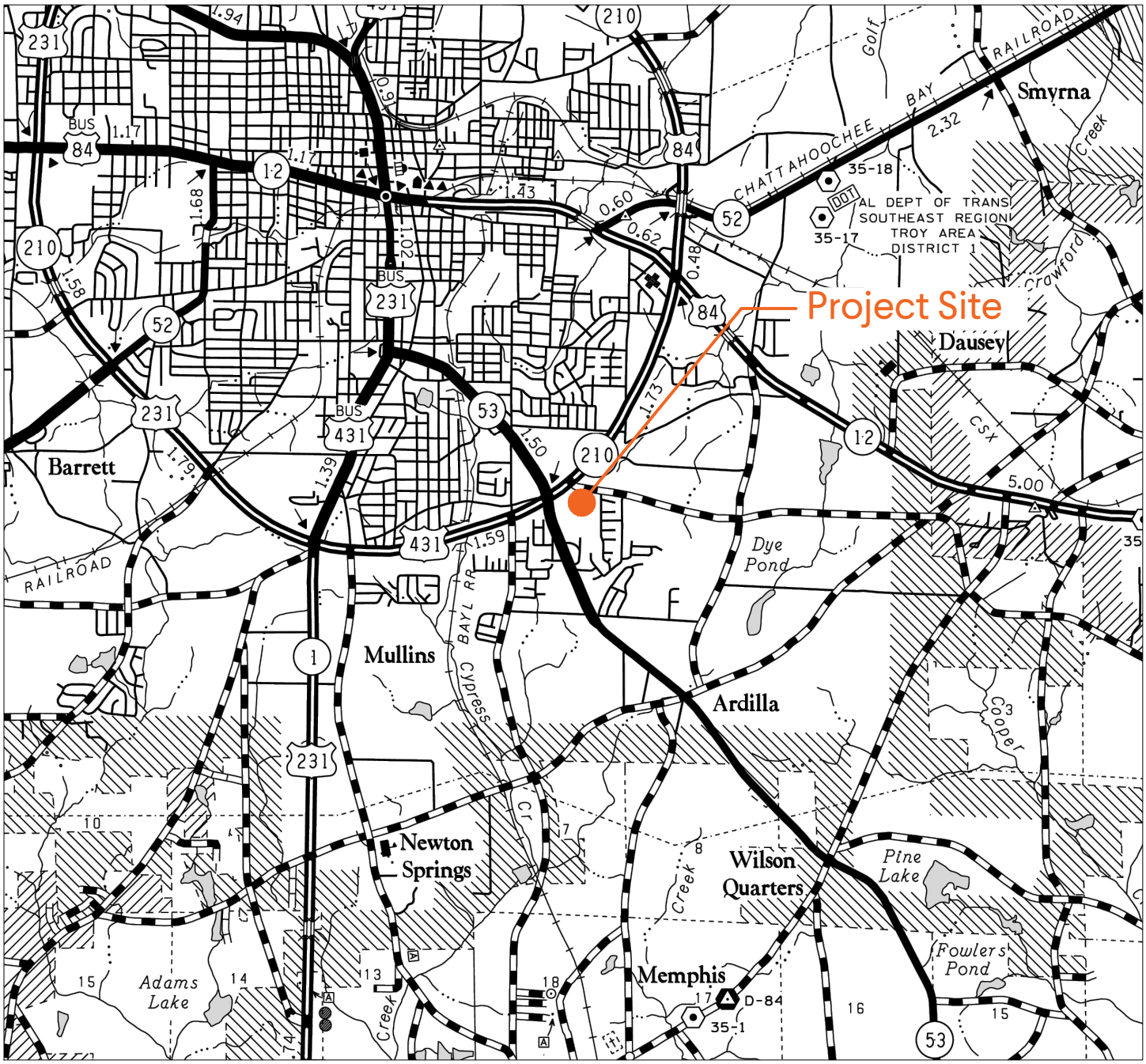
After the plans and specifications are more complete, the geotechnical engineer should be provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At that time, it may be necessary to submit supplementary recommendations.

We emphasize that this report was prepared for design and informational purposes only and may not be sufficient to prepare an accurate construction budget. Contractors reviewing this report should acknowledge that the recommendations contained herein are for design and informational purposes only. In no case should this report be utilized as a substitute for the development of specific earthwork specifications.

The information contained in this report is not intended, nor is sufficient, to aid in the design of segmental or mechanically stabilized earth (MSE) retaining walls. Segmental or MSE wall designers and builders should not rely on this report and should perform independent analysis to determine all necessary soil characteristics for use in their wall design, including but not limited to, soil shear strengths, bearing capacities, global stability, etc.

APPENDIX

Figure 1 – Site Location Map
Figure 2 – Site Geology Map
Figure 3 – USGS Site Map
Figure 4 – Boring Location Plan
Soil Classification Chart
Subsurface Diagrams
Boring Records
Summary of Laboratory Results
Field and Laboratory Procedures



Reference: General Highway Map of Houston County, ALDOT, 2017

DHR Houston County
Dothan, Alabama

Site Location Map

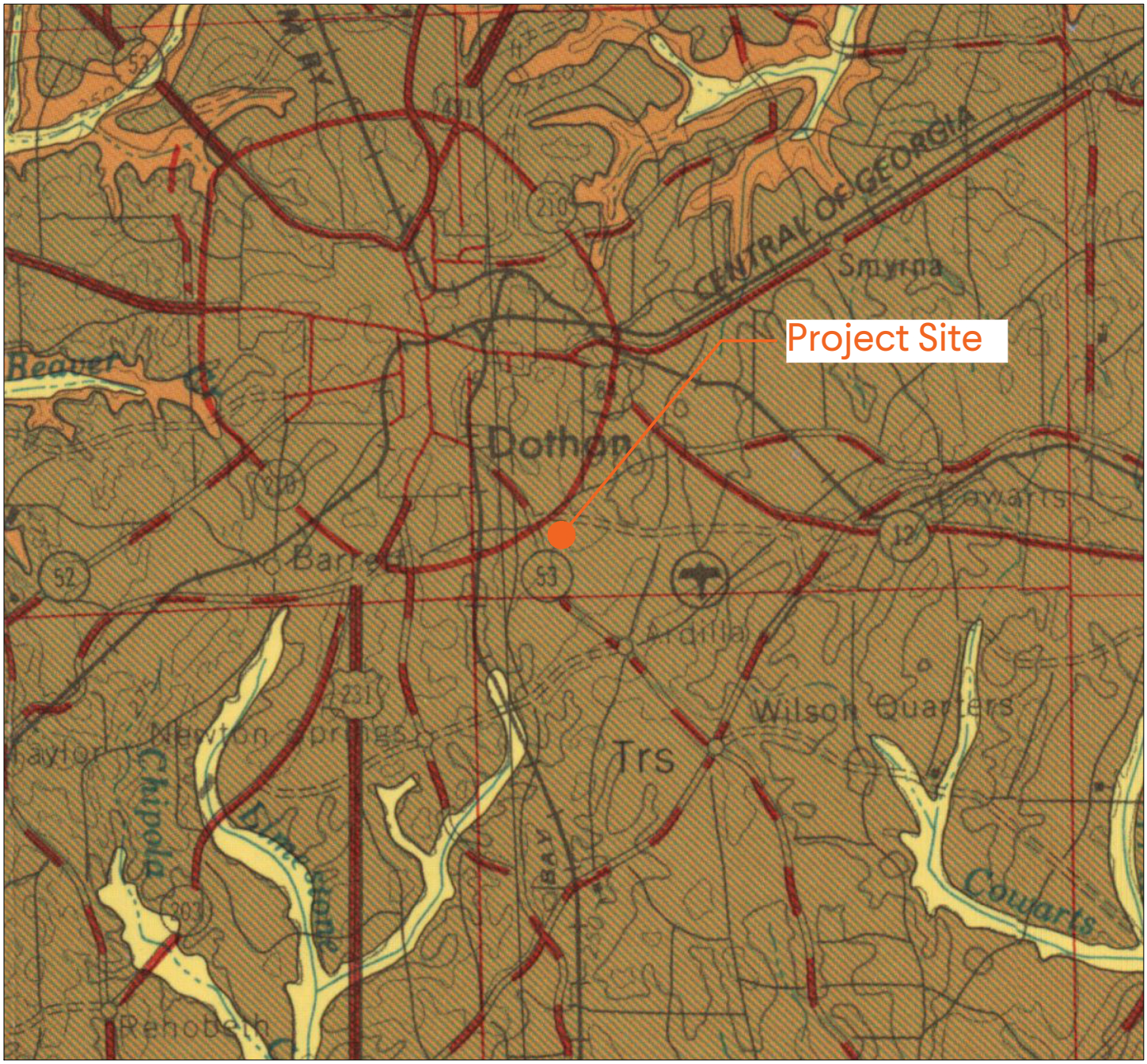
Figure 1

SUPPLEMENTAL DRAWING

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Trs **Residuum (Claiborne/Jackson Group) -** White to moderate-reddish-orange locally mottled sandy clay and residual clay with scattered layer of gravelly medium to coarse sand, fossiliferous chert and limestone boulders and limonitic sand masses.

Reference: Szabo, M.W., and Copeland, C.W. Jr., 1988, Geologic Map of Alabama, Geological Survey of Alabama Special Map 220

DHR Houston County
Dothan, Alabama

Site Geology Map

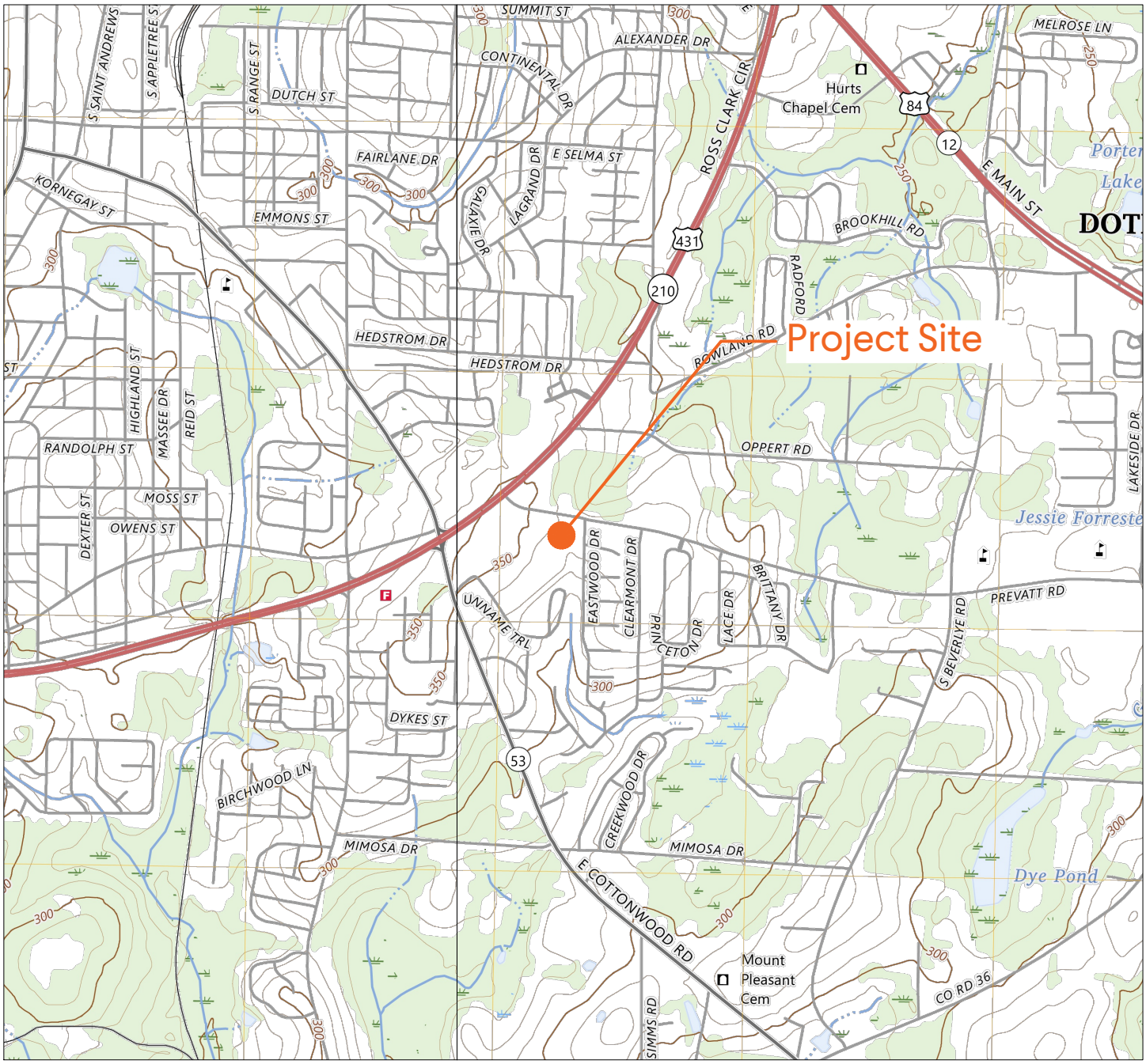
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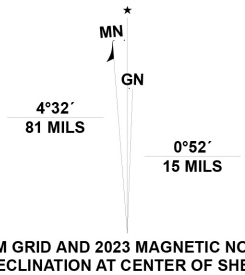
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UTM GRID AND 2023 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET



QUADRANGLE LOCATION

Reference: USGS Quadrangles 7.5 Minute Series (Topographic)

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Dothan, Alabama

Dothan East (2024) | Dothan West (2024)
USGS Site Map

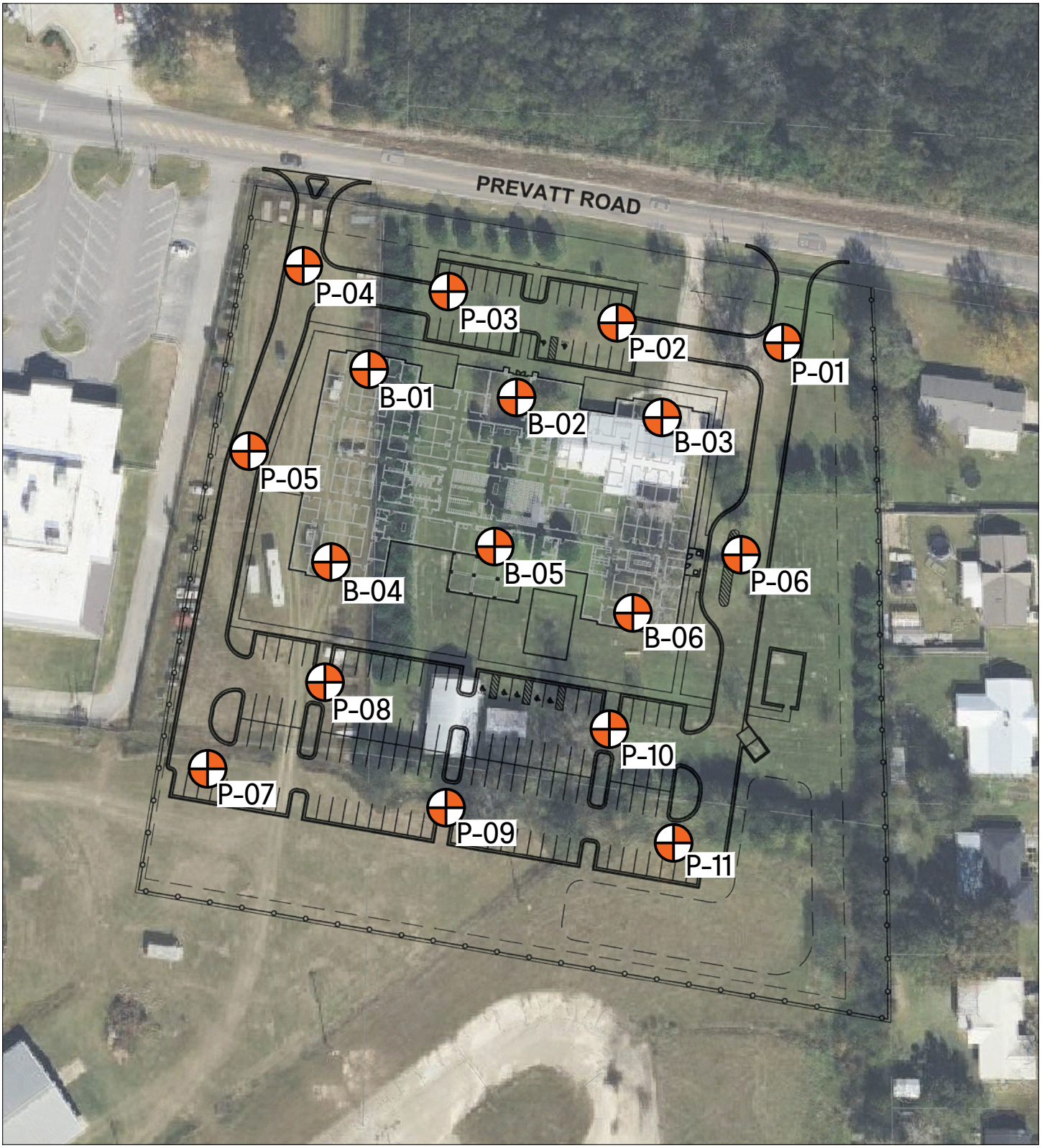
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SUPPLEMENTAL DRAWING

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Approximate Boring Location

Reference: GMC drawing adapted from Google Earth Imagery with Preliminary Site Plan Overlay

DHR Houston County
Dothan, Alabama

Boring Location Plan

Figure 4

SUPPLEMENTAL DRAWING

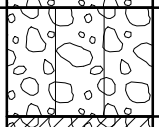
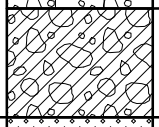
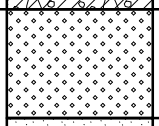
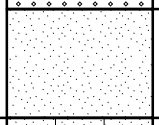
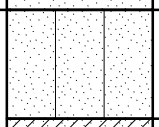
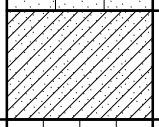
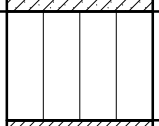
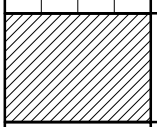
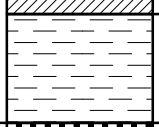
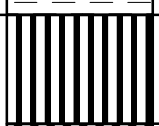
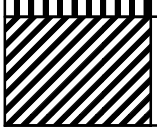
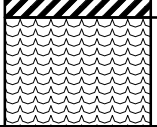
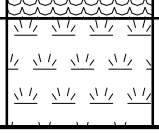
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SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

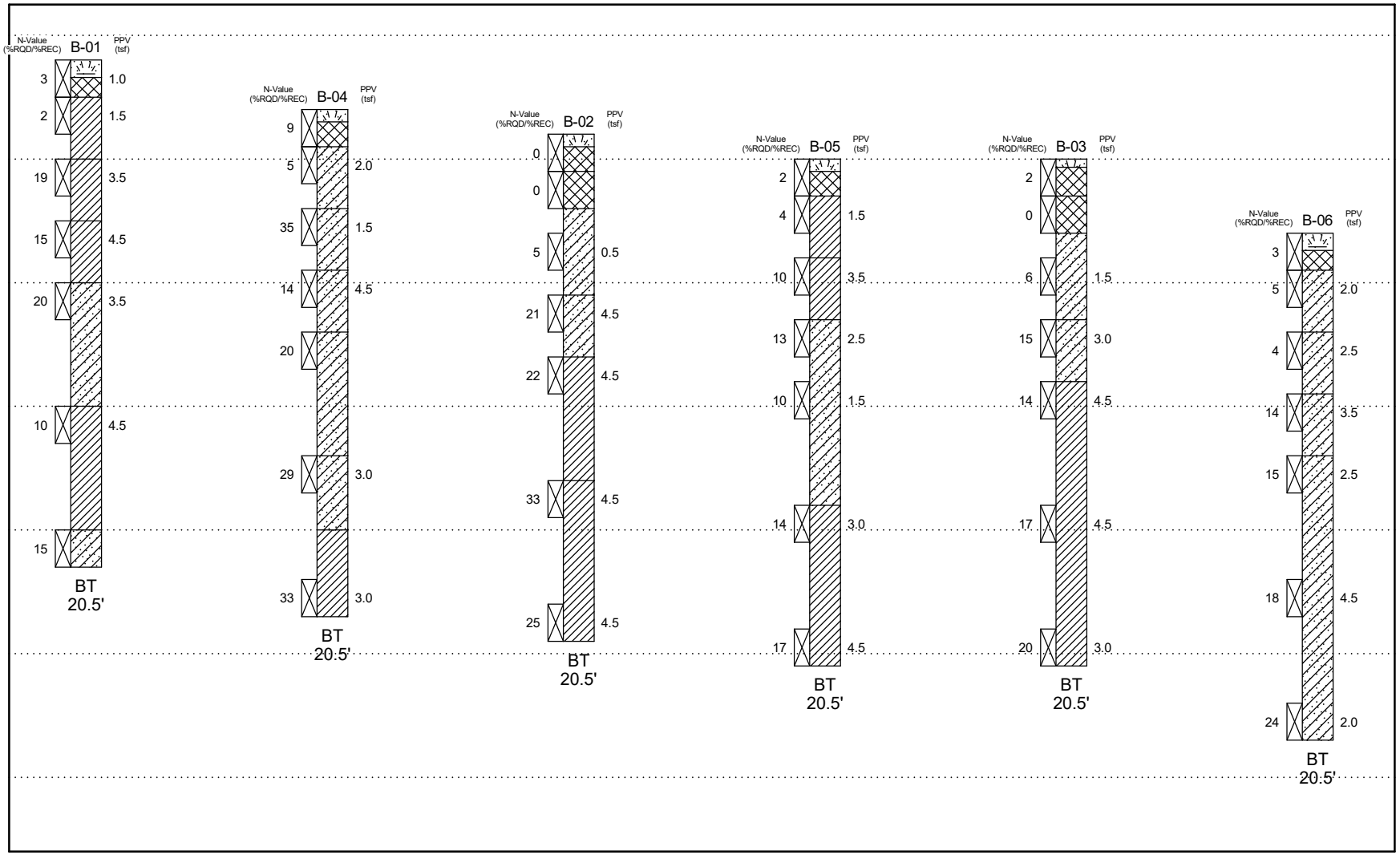
NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SUBSURFACE DIAGRAM A-A'

TOPSOIL FILL CL SC

CLIENT Houston County Commission **PROJECT NAME** DHR Houston County

PROJECT NUMBER GMGM250037 **PROJECT LOCATION** Dothan, AL



BT - Boring Termination
AR - Auger Refusal

Distance Along Baseline (ft)

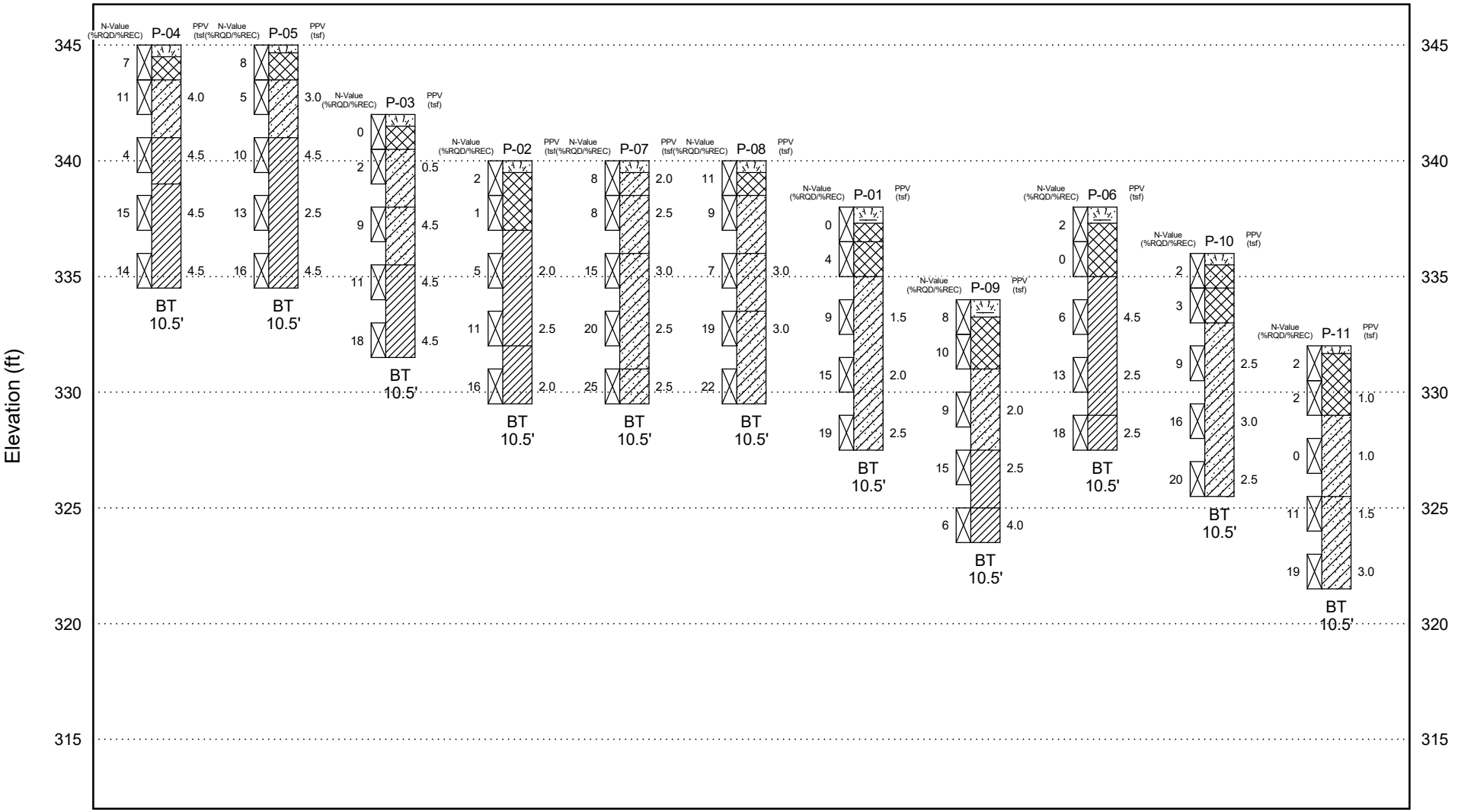
BT-AR DEPTH LOG GMGM250037 DHR HOUSTON COUNTY.GPJ GMC DATA TEMPLATE.GDT 9/5/25

SUBSURFACE DIAGRAM
B-B'

TOPSOIL FILL SC CL

CLIENT Houston County Commission **PROJECT NAME** DHR Houston County

PROJECT NUMBER GMGM250037 **PROJECT LOCATION** Dothan, AL



BT - Boring Termination
AR - Auger Refusal

Distance Along Baseline (ft)

BT-AR DEPTH LOG GMGM250037 DHR HOUSTON COUNTY.GPJ GMC DATA TEMPLATE.GDT 9/5/25

BORING NUMBER B-01

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 344 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 7"										
			SILTY SAND (SM), reddish brown, very loose, w/ organics - FILL	SS		1-2-1 (3)	1.0		15				
			SANDY LEAN CLAY (CL), orangish brown, very soft	SS		1-1-1 (2)	1.5		15				
340													
	5		SANDY LEAN CLAY (CL), light brown, very stiff	SS		6-9-10 (19)	3.5		20				
			SANDY LEAN CLAY (CL), light gray, stiff	SS		5-7-8 (15)	4.5		20				
335													
	10		CLAYEY SAND (SC), pink, medium	SS		6-9-11 (20)	3.5						
330													
	15		SANDY LEAN CLAY (CL), light pink, stiff	SS		5-5-5 (10)	4.5						
325													
	20		CLAYEY SAND (SC), light pink, medium	SS		6-7-8 (15)							
			Boring was terminated at 20.5 feet.										
320													
	25												

BORING NUMBER B-02

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 341 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 5"										
340			SILTY SAND (SM), dark brown, very loose, w/ organics - FILL	SS		1-0-0 (0)			14				
			SILTY SAND (SM), light brown, very loose - FILL	SS		0-0-0 (0)			10				
			CLAYEY SAND (SC), pale brown, reddish brown, loose										
	5			SS		2-2-3 (5)	0.5		16	27	15	12	36
335													
			CLAYEY SAND (SC), reddish brown, light gray, medium	SS		8-10-11 (21)	4.5		21				
	10		SANDY LEAN CLAY (CL), light gray, pinkish brown, very stiff to hard	SS		6-10-12 (22)	4.5						
330													
	15			SS		12-15-18 (33)	4.5						
325													
	20			SS		12-13-12 (25)	4.5						
320			Boring was terminated at 20.5 feet.										
	25												

BORING NUMBER B-03

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 340 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
340	0		Organic Laden Material (OLM), 4"										
			SILTY SAND (SM), dark brown, very loose, w/ organics - FILL	SS		1-1-1 (2)			13				
			SILTY SAND (SM), light brown, very loose - FILL	SS		0-0-0 (0)			7				
			CLAYEY SAND (SC), light brown, loose										
335	5			SS		2-2-4 (6)	1.5		13				
			CLAYEY SAND (SC), light brown, medium	SS		6-6-9 (15)	3.0		15				
330	10		SANDY LEAN CLAY (CL), pinkish brown, orangish brown, stiff to very stiff	SS		7-7-7 (14)	4.5						
325	15			SS		7-8-9 (17)	4.5						
320	20			SS		8-9-11 (20)	3.0						
			Boring was terminated at 20.5 feet.										
315	25												

BORING NUMBER B-04

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 342 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 6"										
			SILTY SAND (SM), dark brown, loose, w/ organics - FILL	SS		4-5-4 (9)			15				
340			CLAYEY SAND (SC), medium brown, loose	SS		3-2-3 (5)	2.0		12	23	11	12	35
	5		CLAYEY SAND (SC), medium brown, dense	SS		12-15-20 (35)	1.5		15				
335			CLAYEY SAND (SC), light brown, pink, medium	SS		7-7-7 (14)	4.5		12				
	10		CLAYEY SAND (SC), pale brown, medium	SS		6-9-11 (20)							
330													
	15		CLAYEY SAND (SC), pink, pale brown, medium	SS		12-13-16 (29)	3.0						
325			SANDY LEAN CLAY (CL), pink, pale brown, hard										
	20			SS		13-14-19 (33)	3.0						
			Boring was terminated at 20.5 feet.										
320													
	25												

BORING NUMBER B-05

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 340 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
340	0		Organic Laden Material (OLM), 6"										
			SILTY SAND (SM), dark brown, very loose, w/ organics - FILL	SS		1-1-1 (2)			11				
			SANDY LEAN CLAY (CL), light brown, soft	SS		1-2-2 (4)	1.5		14				
335	5		SANDY LEAN CLAY (CL), pink, pale brown, stiff	SS		2-4-6 (10)	3.5		14				
			CLAYEY SAND (SC), pink, light brown, medium to loose	SS		4-5-8 (13)	2.5		12				
330	10			SS		4-5-5 (10)	1.5						
325	15		SANDY LEAN CLAY (CL), pink, white, stiff to very stiff	SS		6-6-8 (14)	3.0						
320	20			SS		7-8-9 (17)	4.5						
			Boring was terminated at 20.5 feet.										
315	25												

BORING NUMBER B-06

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 337 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 7"										
			SILTY SAND (SM), dark brown, very loose, w/ organics - FILL	SS		1-1-2 (3)			13	NP	NP	NP	20
335			CLAYEY SAND (SC), brown, loose, w/ trace organics	SS		2-3-2 (5)	2.0		12				
	5		CLAYEY SAND (SC), brown, very loose	SS		2-2-2 (4)	2.5		16				
330			CLAYEY SAND (SC), brown, medium	SS		4-5-9 (14)	3.5		18				
	10		CLAYEY SAND (SC), brown, reddish brown, gray, medium	SS		6-7-8 (15)	2.5						
325													
	15			SS		8-8-10 (18)	4.5						
320													
	20			SS		11-12-12 (24)	2.0						
315			Boring was terminated at 20.5 feet.										
	25												

BORING NUMBER P-01

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 338 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 7"										
			SILTY SAND (SM), dark brown, very loose, w/ organics - FILL	SS		1-0-0 (0)			10				
335			SILTY SAND (SM), brown, very loose, w/ trace organics - FILL	SS		1-2-2 (4)			9				
			CLAYEY SAND (SC), brown, loose to medium										
	5			SS		3-4-5 (9)	1.5		16				
330				SS		6-7-8 (15)	2.0						
	10			SS		7-9-10 (19)	2.5						
			Boring was terminated at 10.5 feet.										
325													
	15												
320													
	20												
315													
	25												

1.GMC BORINGS GMGM250037 DHR HOUSTON COUNTY.GPJ GMC DATA TEMPLATE.GDT 9/8/25

BORING NUMBER P-02

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 340 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
340	0		Organic Laden Material (OLM), 5"										
			SILTY SAND (SM), dark brown, very loose - FILL	SS		1-1-1 (2)			11				
				SS		1-1-0 (1)			6				
			SANDY LEAN CLAY (CL), brown, medium to stiff										
335	5			SS		2-2-3 (5)	2.0		14				
				SS		6-6-5 (11)	2.5						
			SANDY LEAN CLAY (CL), brown, very stiff										
330	10			SS		8-8-8 (16)	2.0						
			Boring was terminated at 10.5 feet.										
325	15												
320	20												
315	25												

BORING NUMBER P-03

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 342 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 5"										
			SILTY SAND (SM), dark brown, very loose, w/ organics - FILL	SS		0-0-0 (0)			14				
340			CLAYEY SAND (SC), brown, very loose	SS		1-1-1 (2)	0.5		14				
	5		CLAYEY SAND (SC), pink, white, loose	SS		2-4-5 (9)	4.5		15				
335			SANDY LEAN CLAY (CL), pale brown, white, stiff to very stiff	SS		5-5-6 (11)	4.5						
	10			SS		6-7-11 (18)	4.5						
			Boring was terminated at 10.5 feet.										
330													
	15												
325													
	20												
320													
	25												

BORING NUMBER P-04

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 345 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
345	0		Organic Laden Material (OLM), 5"										
			SILTY SAND (SM), dark brown, loose - FILL	SS		3-4-3 (7)			14				
			CLAYEY SAND (SC), dark brown, medium	SS		4-5-6 (11)	4.0		12	21	11	10	39
340	5		SANDY LEAN CLAY (CL), pink, gray, soft	SS		1-2-2 (4)	4.5		25				
			SANDY LEAN CLAY (CL), pink, gray, stiff	SS		6-6-9 (15)	4.5						
335	10			SS		4-5-9 (14)	4.5						
			Boring was terminated at 10.5 feet.										
330	15												
325	20												
320	25												

1.GMC BORINGS GMGM250037 DHR HOUSTON COUNTY.GPJ GMC DATA TEMPLATE.GDT 9/8/25

BORING NUMBER P-05

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 345 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
345	0		Organic Laden Material (OLM), 4"										
			SILTY SAND (SM), dark brown, loose - FILL	SS		3-4-4 (8)			14				
			CLAYEY SAND (SC), brown, loose	SS		2-2-3 (5)	3.0		16				
340	5		SANDY LEAN CLAY (CL), pink, gray, light brown, stiff to very stiff	SS		2-4-6 (10)	4.5		16				
				SS		6-6-7 (13)	2.5						
335	10			SS		4-7-9 (16)	4.5						
			Boring was terminated at 10.5 feet.										
330	15												
325	20												
320	25												

BORING NUMBER P-06

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 338 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 7"										
			SILTY SAND (SM), dark brown, very loose, w/ organics - FILL	SS		1-1-1 (2)			14				
335				SS		0-0-0 (0)			11				
			SANDY LEAN CLAY (CL), reddish brown, white, medium to stiff										
	5			SS		2-3-3 (6)	4.5		26				
330				SS		6-6-7 (13)	2.5						
	10		SANDY LEAN CLAY (CL), reddish brown, white, very stiff	SS		7-8-10 (18)	2.5						
			Boring was terminated at 10.5 feet.										
325													
	15												
320													
	20												
315													
	25												

BORING NUMBER P-07

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 340 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
340	0		Organic Laden Material (OLM), 6"										
			CLAYEY SAND (SC), brown, dark brown, loose, w/ organics	SS		3-4-4 (8)	2.0		13				
			CLAYEY SAND (SC), yellowish brown, loose	SS		2-3-5 (8)	2.5		18				
335	5		CLAYEY SAND (SC), yellowish brown, medium	SS		4-7-8 (15)	3.0		19				
				SS		6-8-12 (20)	2.5						
330	10		CLAYEY SAND (SC), pink, reddish brown, medium	SS		0-12-13 (25)	2.5						
			Boring was terminated at 10.5 feet.										
325	15												
320	20												
315	25												

BORING NUMBER P-08

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 340 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
340	0		Organic Laden Material (OLM), 5"										
			SILTY SAND (SM), dark brown, medium - FILL	SS		4-5-6 (11)			16				
			CLAYEY SAND (SC), brown, loose, w/ organics	SS		4-4-5 (9)			12				
335	5		CLAYEY SAND (SC), dark reddish brown, loose	SS		6-3-4 (7)	3.0		17				
			CLAYEY SAND (SC), pale brown, medium	SS		5-9-10 (19)	3.0						
330	10			SS		8-10-12 (22)							
			Boring was terminated at 10.5 feet.										
325	15												
320	20												
315	25												

BORING NUMBER P-09

GMC

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 334 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 9"										
			SILTY SAND (SM), dark brown, loose, w/ organics - FILL	SS		2-3-5 (8)			12	NP	NP	NP	22
				SS		3-5-5 (10)			9				
330			CLAYEY SAND (SC), brown, loose										
	5			SS		3-4-5 (9)	2.0		13				
			SANDY LEAN CLAY (CL), brown, gray, stiff	SS		5-7-8 (15)	2.5						
325													
	10		SANDY LEAN CLAY (CL), brown, gray, medium	SS		3-3-3 (6)	4.0						
			Boring was terminated at 10.5 feet.										
320													
	15												
315													
	20												
310													
	25												

1.GMC BORINGS GMGM250037 DHR HOUSTON COUNTY.GPJ GMC DATA TEMPLATE.GDT 9/8/25

BORING NUMBER P-10

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 336 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 6"										
335			SILTY SAND (SM), dark brown, very loose, w/ organics - FILL	SS		1-1-1 (2)			11				
			SILTY SAND (SM), light brown, very loose- FILL	SS		1-1-2 (3)			10				
			CLAYEY SAND (SC), brown, loose to medium										
	5			SS		3-4-5 (9)	2.5		11				
330													
				SS		5-7-9 (16)	3.0						
			- reddish brown	SS		8-9-11 (20)	2.5						
	10												
325			Boring was terminated at 10.5 feet.										
	15												
320													
	20												
315													
	25												

BORING NUMBER P-11

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 332 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 4"										
			SILTY SAND (SM), dark brown, very loose - FILL	SS		0-1-1 (2)			12				
330				SS		1-1-1 (2)	1.0		9				
			CLAYEY SAND (SC), brown, very loose										
	5			SS		0-0-0 (0)	1.0		15				
325			CLAYEY SAND (SC), brown, white, medium	SS		4-5-6 (11)	1.5						
	10			SS		8-9-10 (19)	3.0						
			Boring was terminated at 10.5 feet.										
320													
	15												
315													
	20												
310													
	25												

1.GMC BORINGS GMGM250037 DHR HOUSTON COUNTY.GPJ GMC DATA TEMPLATE.GDT 9/8/25

SUMMARY OF LABORATORY RESULTS

CLIENT Houston County Commission **PROJECT NAME** DHR Houston County

PROJECT NUMBER GMGM250037 **PROJECT LOCATION** Dothan, AL

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Max. Sieve Size Tested (mm)	%<#200 Sieve	Natural Moisture (%)	Class-ification	Opt. Moisture Content (%)	Max Dry Density (pcf)	Specific Gravity
B-01	0-1.5						15.3				
B-01	1.5-3						14.8				
B-01	4-5.5						19.8				
B-01	6.5-8						20.3				
B-02	0-1.5						13.8				
B-02	1.5-3						9.7				
B-02	4-5.5	27	15	12	9.5	36	16.0	SC			
B-02	6.5-8						20.8				
B-03	0-1.5						13.0				
B-03	1.5-3						7.2				
B-03	4-5.5						12.9				
B-03	6.5-8						14.9				
B-04	0-1.5						15.4				
B-04	1.5-3	23	11	12	4.75	35	12.0	SC			
B-04	4-5.5						14.6				
B-04	6.5-8						11.7				
B-05	0-1.5						11.4				
B-05	1.5-3						14.4				
B-05	4-5.5						13.6				
B-05	6.5-8						11.6				
B-06	0-1.5	NP	NP	NP	9.5	20	12.6	SM			
B-06	1.5-3						11.6				
B-06	4-5.5						16.3				
B-06	6.5-8						18.4				
P-01	0-1.5						9.8				
P-01	1.5-3						9.2				
P-01	4-5.5						15.6				
P-02	0-1.5						11.4				
P-02	1.5-3						5.5				
P-02	4-5.5						13.6				
P-03	0-1.5						14.2				
P-03	1.5-3						14.1				
P-03	4-5.5						15.0				
P-04	0-1.5						13.8				
P-04	1.5-3	21	11	10	9.5	39	12.0	SC			
P-04	4-5.5						24.8				
P-05	0-1.5						13.7				
P-05	1.5-3						15.7				
P-05	4-5.5						16.4				
P-06	0-1.5						13.9				
P-06	1.5-3						10.9				
P-06	4-5.5						25.7				
P-07	0-1.5						12.5				

SUMMARY OF LABORATORY RESULTS

CLIENT Houston County Commission **PROJECT NAME** DHR Houston County

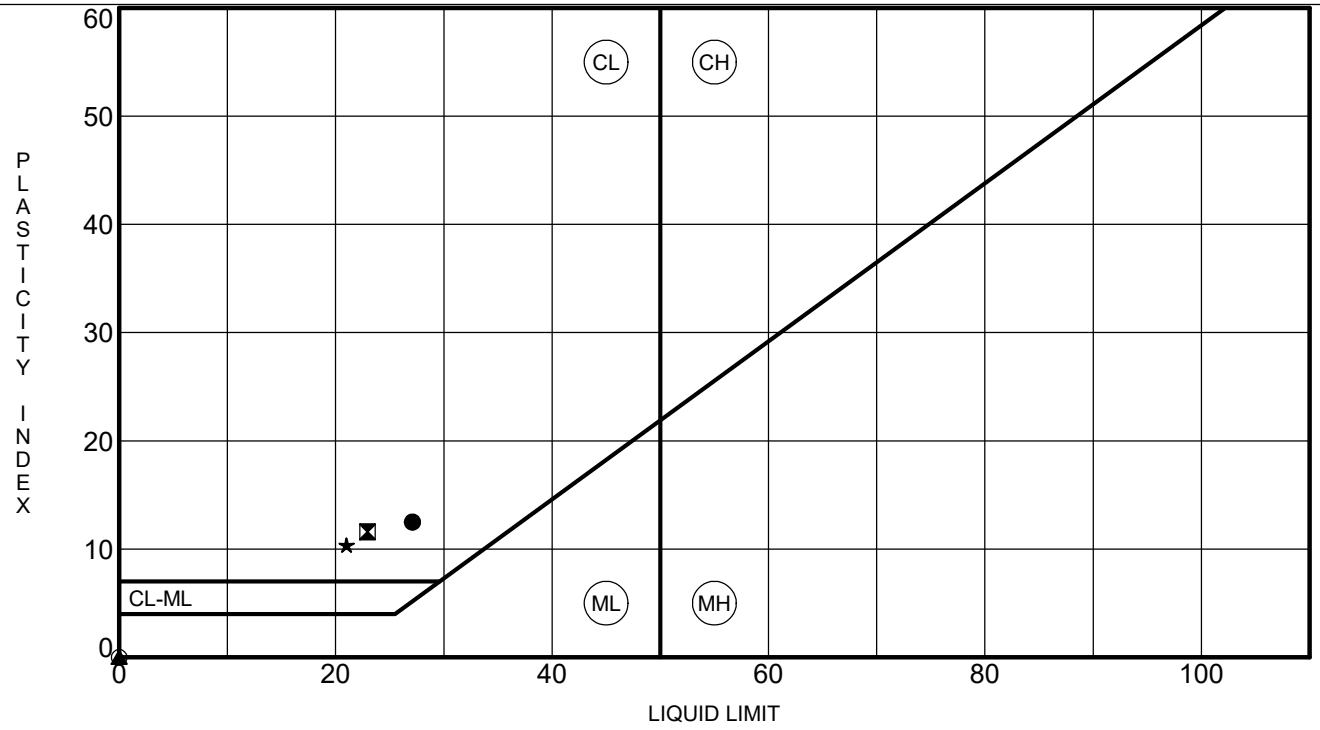
PROJECT NUMBER GMGM250037 **PROJECT LOCATION** Dothan, AL

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Max. Sieve Size Tested (mm)	%<#200 Sieve	Natural Moisture (%)	Class-ification	Opt. Moisture Content (%)	Max Dry Density (pcf)	Specific Gravity
P-07	1.5-3						17.9				
P-07	4-5.5						19.1				
P-08	0-1.5						15.7				
P-08	1.5-3						12.1				
P-08	4-5.5						16.9				
P-09	0-1.5	NP	NP	NP	9.5	22	12.1	SM			
P-09	1.5-3						8.9				
P-09	4-5.5						12.9				
P-10	0-1.5						11.1				
P-10	1.5-3						9.7				
P-10	4-5.5						11.5				
P-11	0-1.5						11.9				
P-11	1.5-3						8.5				
P-11	4-5.5						15.2				

ATTERBERG LIMITS' RESULTS

CLIENT Houston County Commission **PROJECT NAME** DHR Houston County

PROJECT NUMBER GMGM250037 **PROJECT LOCATION** Dothan, AL

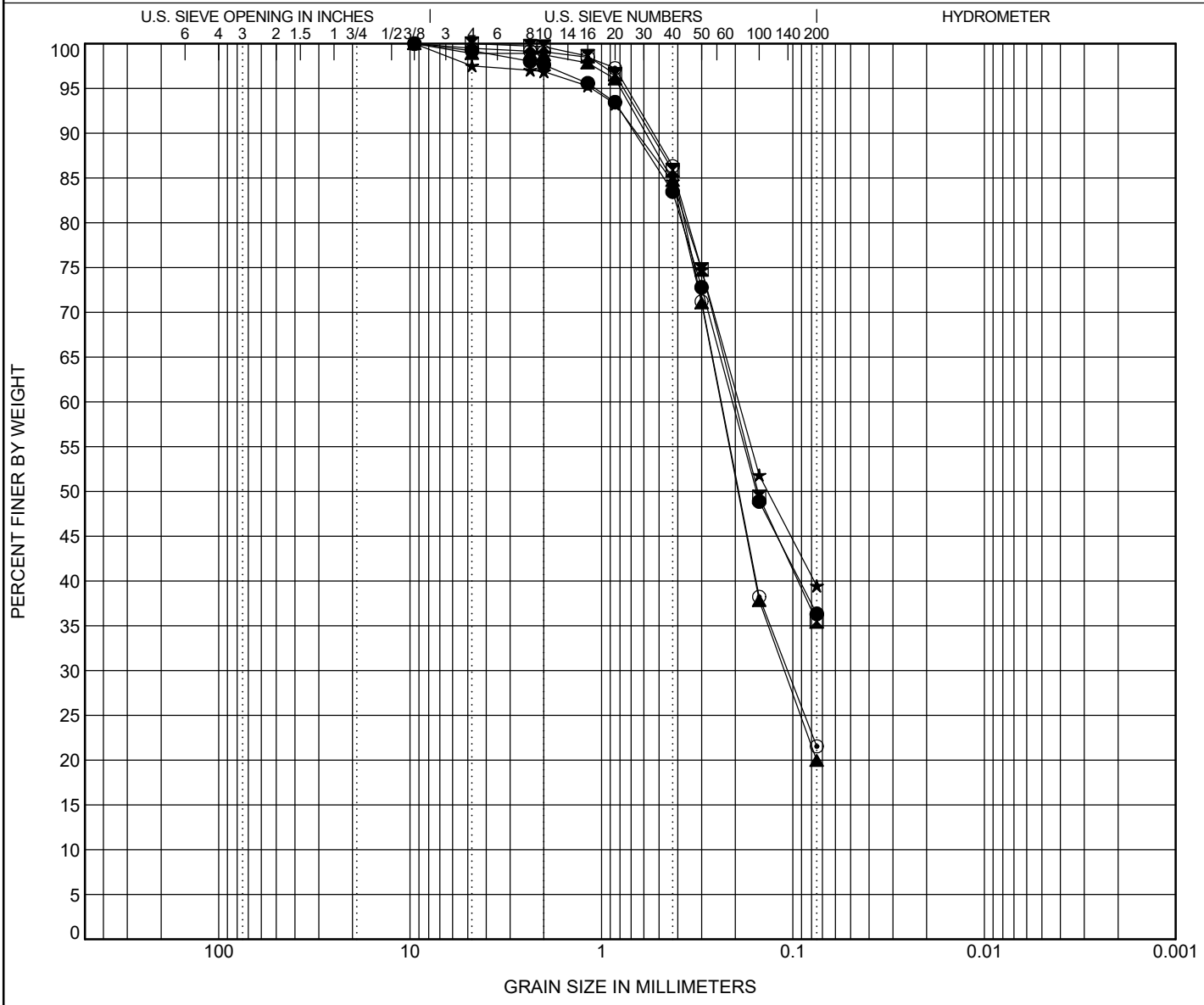


	Specimen Identification		LL	PL	PI	Fines	Classification
●	**B-02**	**4.0-5.5**	**27**	**15**	**12**	**36**	**CLAYEY SAND(SC)**
⊠	**B-04**	**1.5-3.0**	**23**	**11**	**12**	**35**	**CLAYEY SAND(SC)**
▲	**B-06**	**0.0-1.5**	**NP**	**NP**	**NP**	**20**	**SILTY SAND(SM)**
★	**P-04**	**1.5-3.0**	**21**	**11**	**10**	**39**	**CLAYEY SAND(SC)**
⊙	**P-09**	**0.0-1.5**	**NP**	**NP**	**NP**	**22**	**SILTY SAND(SM)**

GRAIN SIZE DISTRIBUTION

CLIENT Houston County Commission **PROJECT NAME** DHR Houston County

PROJECT NUMBER GMGM250037 **PROJECT LOCATION** Dothan, AL



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-02	4.0-5.5	CLAYEY SAND(SC)	27	15	12		
⊠	B-04	1.5-3.0	CLAYEY SAND(SC)	23	11	12		
▲	B-06	0.0-1.5	SILTY SAND(SM)	NP	NP	NP		
★	P-04	1.5-3.0	CLAYEY SAND(SC)	21	11	10		
⊙	P-09	0.0-1.5	SILTY SAND(SM)	NP	NP	NP		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-02	4.0-5.5	9.5	0.207			0.8	62.9	36.3	
⊠	B-04	1.5-3.0	4.75	0.2			0.0	64.5	35.5	
▲	B-06	0.0-1.5	9.5	0.238	0.111		1.1	78.9	20.0	
★	P-04	1.5-3.0	9.5	0.192			2.5	58.1	39.5	
⊙	P-09	0.0-1.5	9.5	0.237	0.107		0.5	77.9	21.5	

GMC

FIELD TEST PROCEDURES

General

The general field procedures employed by Goodwyn Mills Cawood, LLC (GMC), are summarized in the American Society for Testing and Materials (ASTM) Standard D420 which is entitled "Investigating and Sampling Soil and Rock". This recommended practice lists recognized methods for determining soil and rock distribution and groundwater conditions. These methods include geophysical and in-situ methods as well as borings.

The detailed collection methods used during this exploration are presented in the following paragraphs.

Standard Drilling Techniques

General: To obtain subsurface samples, borings are drilled using one of several alternate techniques depending upon the subsurface conditions. These techniques are as follows:

In Soils:

a) Continuous hollow stem augers.
b) Rotary borings using roller cone bits or drag bits, and water or drilling mud to flush the hole.
c) "Hand" augers.

In Rock:

a) Core drilling with diamond-faced, double or triple tube core barrels.
b) Core boring with roller cone bits.

Hollow Stem Auger: A hollow stem augers consists of a hollow steel tube with a continuous exterior spiral flange termed a flight. The auger is turned into the ground, returning the cuttings along the flights. The hollow center permits a variety of sampling and testing tools to be used without removing the auger.

Rotary Borings: Rotary drilling involves the use of roller cone or drag type drill bits attached to the end of drill rods. A flushing medium, normally water or bentonite slurry, is pumped through the rods to clear the cuttings from the bit face and flush them to the surface. Casing is sometimes set behind the advancing bit to prevent the hole from collapsing and to restrict the penetration of the drilling fluid into the surrounding soils. Cuttings returned to the surface by the drilling fluid are typically collected in a settling tank, to allow the fluid to be recirculated.

Hand Auger Boring: Hand auger borings are advanced by manually twisting a 4" diameter steel bucket auger into the ground and withdrawing it when filled to observe the sample collected. Posthole diggers are sometimes used in lieu of augers to obtain shallow soil samples. Occasionally these hand auger borings are used for driving 3-inch diameter steel tubes to obtain intact soil samples.

Dual-Mass Dynamic Cone Penetrometer: Dual-Mass Dynamic Cone Penetrometer tests (DM-DCP) test is intended to provide data that can be correlated to an in situ California Bearing Ratio test. A 0.79-inch O.D. cone is seated at the test location and driven with a 17.6-pound (or 10.1-pound) weight falling 22.6 inches. The length of penetration is recorded with a given number of blows. The values are then evaluated and correlated with an in situ CBR.

Dynamic Cone Penetrometer: Dynamic Cone Penetrometer tests (DCP) is intended to provide data that can be correlated to the standard penetration test (SPT). A 1.5 inch O.D. cone is seated to penetrate any loose cuttings, then driven three, 1-3/4" increments with blows from a 15-pound weight falling 20 inches. The average number of blows required to drive the cone three increments is an index to soil strength and compressibility.

Core Drilling: Soil drilling methods are not normally capable of penetrating through hard cemeted soil, weathered rock, coarse gravel or boulders, thin rock seams, or the upper surface of sound, continuous rock. Material that cannot be penetrated by auger or rotary soil-drilling methods at a reasonable rate is designated as “refusal material”. Core drilling procedures are required to penetrate and sample refusal materials.

Prior to coring, casing may be set in the drilled hole through the overburden soils, to keep the hole from caving and to prevent excessive water loss. The refusal materials are then cored according to ASTM D2113 using a diamond studded bit fastened to the end of a hollow, double or triple tube core barrel. This device is rotated at high speeds, and the cuttings are brought to the surface by circulating water. Core samples of the material penetrated are protected and retained in the swivel-mounted inner tube. Upon completion of each drill run, the core barrel is brought to the surface, the core recovery is measured, and the core is placed, in sequence, in boxes for storage and transported to our laboratory.

Sampling and Testing in Boreholes

General: Several techniques are used to obtain samples and data in soils; however, the most common methods in this area are:

a) Standard Penetrating Testing
b) Water Level Readings

These procedures are presented below. Any additional testing techniques employed during this exploration are contained in other sections of the Appendix.

Standard Penetration Testing: At regular intervals, the drilling tools are removed and soil samples obtained with a standard 2-inch diameter split tube sampler connected to an A or N-size rod. The sampler is first seated 6 inches to penetrate any loose cuttings, and then driven an additional 12 inches with blows of a 140-pound safety hammer falling 30 inches. Generally, the number of hammer blows required to drive the sampler the final 12 inches is designated the "penetration resistance" or "N" value, in blows per foot (bpf). The split barrel sampler is designed to retain the soil penetrated, so that it may be returned to the surface for observation. Representative portions of the soil samples obtained from each split barrel sample are placed in jars, sealed and transported to our laboratory.

The standard penetration test, when properly evaluated, provides an indication of the soil strength and compressibility. The tests are conducted according to ASTM Standard D1586. The depths and N-values of standard penetration tests are shown on the Boring Records. Split barrel samples are suitable for visual observation and classification tests but are not sufficiently intact for quantitative laboratory testing.

Water Level Readings: Water table readings are normally taken in the borings and are recorded on the Boring Records. In sandy soils, these readings indicate the approximate location of the hydrostatic water table at the time of our field exploration. In clayey soils, the rate of water seepage into the borings is low and it is generally not possible to establish the location of the hydrostatic water table through short-term water level readings. Also, fluctuation in the water table should be expected with variations in precipitation, surface run-off, evaporation, and other factors. For long-term monitoring of water levels, it is necessary to install piezometers. The water levels reported on the Boring Records are determined by field crews immediately after the drilling tools are removed, and several hours after the borings are completed, if possible. The time lag is intended to permit stabilization of the groundwater table, which may have been disrupted by the drilling operation.

Occasionally the borings will cave-in, preventing water level readings from being obtained or trapping drilling water above the cave-in zone. The cave-in depth is measured and recorded on the Boring Records.

Boring Records

The subsurface conditions encountered during drilling are reported on a field boring record prepared by the Driller. The record contains information concerning the boring method, samples attempted and recovered, indications of the presence of coarse gravel, cobbles, etc., and observations of ground water. It also contains the driller's interpretation of the soil conditions between samples. Therefore, these boring records contain both factual and interpretive information. The field boring records are kept on file in our office.

After the drilling is completed, a geotechnical professional classifies the soil samples and prepares the final Boring Records, which are the basis for all evaluations and recommendations. The following terms are taken from ASTM D2487 or Deere's Technical Description of Rock Cores for Engineering Purposes, Rock Mechanical Engineering Geology 1, pp. 18-22.

Relative Density of Cohesionless Soils From Standard Penetration Test	
Very Loose	‹ 4 bpf
Loose	5 - 10 bpf
Medium	11 – 30 bpf
Dense	31 - 50 bpf
Very Dense	› 50 bpf
(bpf = blows per foot, ASTM D 1586)	

Consistency of Cohesive Soils	
Very Soft	‹ 2 bpf
Soft	3 - 4 bpf
Medium	5 - 8 bpf
Stiff	9 - 15 bpf
Very Stiff	16 - 30 bpf
Hard	› 30 bpf

Relative Hardness of Rock
Very Soft Rock disintegrates or easily compresses to touch; can be hard to very hard soil.
Soft Rock may be broken with fingers.
Moderately Soft Rock may be scratched with a nail, corners and edges may be broken with fingers.
Moderately Hard Rock a light blow of hammer is required to break samples.
Hard Rock a hard blow of hammer is required to break sample.

Particle Size Identification	
Boulders	Larger than 12"
Cobbles	3" - 12"
Gravel	
Coarse	3/4" - 3"
Fine	4.76mm - 3/4"
Sand	
Coarse	2.0 - 4.76 mm
Medium	0.42 - 2.00 mm
Fine	0.42 - 0.074 mm
Fines (Silt or Clay)	Smaller than 0.074 mm

Rock Continuity

RECOVERY = $\frac{\text{Total Length of Core}}{\text{Length of Core Run}}$ x 100 %

Description	Core Recovery %
Incompetent	Less than 40
Competent	40 - 70
Fairly Continuous	71 - 90
Continuous	91 - 100

Relative Quality of Rocks

RQD = $\frac{\text{Total core, counting only pieces › 4" long}}{\text{Length of Core Run}}$ x 100 %

Description	RQD %
Very Poor	0 - 25 %
Poor	25 - 50 %
Fair	50 - 75 %
Good	75 - 90 %
Excellent	90 - 100 %

GMC

LABORATORY TESTING

GENERAL

The laboratory testing procedures employed by Goodwyn Mills Cawood, LLC (GMC) are in general accordance with ASTM standard methods and other applicable specifications. Several test methods, described together with others in this Appendix, were used during the course of this exploration. The Laboratory Data Summary sheet indicates the specific tests performed.

SOIL CLASSIFICATION

Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply past experience to current problems. In our investigations, samples obtained during drilling operations are examined in our laboratory and visually classified by an engineer. The soils are classified according to consistency (based on number of blows from standard penetration tests), color and texture. These classification descriptions are included on our "Boring Records".

The classification system discussed above is primarily qualitative and for detailed soil classification, two laboratory tests are commonly performed: grain size tests and plasticity tests. Using these test results the soil can be classified according to the AASHTO or Unified Classification Systems (ASTM D2487). Each of these classification systems and the in-place physical soil properties provides an index for estimating the soil's behavior. The soil classification and physical properties obtained are presented in this report.

POCKET PENETROMETER TEST

A pocket penetrometer test is performed by pressing the tip of a small, spring-loaded penetrometer with even pressure to a prescribed depth into a soil sample. This test yields a value for unconfined compressive strength, which may be correlated with unconfined compressive strengths obtained by other laboratory methods.

MOISTURE CONTENT

Moisture contents are determined from representative portions of the specimen. The soil is dried to a constant weight in an oven at 100° C and the loss of moisture during the drying process is measured. From this data, the moisture content is computed.

ATTERBERG LIMITS

Liquid Limit (LL), Plastic Limit (PL) and Shrinkage Limit (SL) tests are performed to aid in the classification of soils and to determine the plasticity and volume change characteristics of the materials. The Liquid Limit is the minimum moisture content at which a soil will flow as a heavy viscous fluid. The Plastic Limit is the minimum moisture content at which the soil behaves as a plastic material. The Shrinkage Limit is the moisture content below which no further volume change will take place with continued drying. The Plasticity Index (PI) is the numeric difference of Liquid Limit and Plastic Limit and indicates the range of moisture content over which a soil remains plastic. These tests are performed in accordance with ASTM D4318, D4943 and D427.

PARTICLE SIZE DISTRIBUTION

The distribution of soils coarser than the No. 200 (75-mm) sieve is determined by passing a representative specimen through a standard set of nested sieves. The weight of material retained on each sieve is determined and the percentage retained (or passing) is calculated.

A specimen may be washed through only the No. 200 sieve, if the full range of particle sizes is not required. The percentage of material passing the No. 200 sieve is reported.

The distribution of materials finer than the No. 200 sieve is determined by use of a hydrometer. The particle sizes and distribution are computed from the time rate of settlement of the different size particles while suspended in water. These tests are performed in accordance with ASTM D421, D422 and D1140.

Alabama Department of Human Resources
DHR – Houston County

DOTHAN, HOUSTON COUNTY, ALABAMA

September 9, 2025

REPORT OF GEOTECHNICAL EXPLORATION

Prepared By

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GMC PROJECT NUMBER: GMGM250037

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September 9, 2025

Ms. Jacquelyn Hart, AIA
Goodwyn Mills Cawood, LLC
2400 5th Avenue South
Suite 200
Birmingham, Alabama 35233

RE: REPORT OF GEOTECHNICAL EXPLORATION
ALABAMA DEPARTMENT OF HUMAN RESOURCES
DHR – HOUSTON COUNTY
DOTHAN, HOUSTON COUNTY, ALABAMA
GMC PROJECT NO. GMGM250037

Dear Ms. Hart,

Goodwyn Mills Cawood, LLC (Geotechnical & Construction Services Division) is pleased to provide this report of geotechnical exploration performed for the above referenced project. This report includes the results of field and laboratory testing and general recommendations for foundation design and sitework.

We appreciate the opportunity to perform this study during this phase of the project for you and look forward to continued participation during the construction phase of this project. If you have any questions pertaining to this report, or if we may be of further service, please do not hesitate to call.

Sincerely,
GOODWYN MILLS CAWOOD, LLC

David D. Gamlin, PE
Project Engineer
Licensed Alabama 51465

Michael J. McNeill, PE
Vice President
Licensed Alabama 26331



GMC

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Subsurface Diagrams
Boring Records
Summary of Laboratory Results
Field and Laboratory Procedures

1.0 EXECUTIVE SUMMARY

A geotechnical exploration has been conducted for the proposed Alabama Department of Human Resources (DHR) Office Building to be located on Prevatt Road in Dothan, Houston County, Alabama. The proposed site is currently adjacent (east) to the existing DHR Office Building which is located at the southwest corner of U.S. 431 and Prevatt Road.

We have been provided with a preliminary site outline; however, detailed grading and structural information have not been provided at the time of this report. The site has been previously developed and is relatively level. We understand that the proposed office building will be approximately 45,000 square feet. We anticipate future building and parking grades to be within approximately 5 feet of current site elevations. Likewise, we have assumed maximum column and wall loads of 150 kips and 4 kips/foot, respectively, and construction will be masonry (CMU) type with steel joists.

- A total of seventeen (17) soil test borings were drilled at the site. Six (6) borings were drilled in the proposed building footprint to a depth of 20 feet each. Eleven (11) borings were drilled in the planned parking and drive areas to a depth of 10 feet each.
- The borings initially encountered 4 to 9 inches of organic-laden material (topsoil) across the site.
- The borings predominantly encountered approximately 2 to 3 feet of existing fill material generally classified very loose to medium silty sand (SM). Standard Penetration Test (SPT) N-Values in these materials ranged from 0 to 10 blows per foot (bpf).
- Below the existing fill materials, the borings typically encountered varying layers of very loose to dense clayey sand (SC) and very soft to hard sandy lean clay (CL) to the boring termination depths. The borings generally encountered soils with more clay and higher consistency with increasing depth below the surface. SPT N-Values in these materials ranged from 2 to 35 bpf.
- Groundwater was not encountered at the time of drilling.
- The site should be suitable for development, provided it is prepared herein. The main development issue for this site will be the low consistency soils (SPT N-values ‹ 8 bpf) and existing fill in the upper 4 to 6 feet of the existing subgrade elevation.
- **We recommend an allowance for the removal and replacement of approximately 4 feet of unsuitable materials within the building footprint and 2 feet within the pavement areas be included in the bid documents.** The undercut area should extend ten (10) feet beyond the building and five (5) feet beyond the parking areas.
- An additional option of geotextile and stone should also be considered and budgeted as well, if pavement areas require further stabilization beyond the upper two (2) feet.
- We recommend that conventional shallow foundations should be sized for a maximum allowable bearing capacity of 2,000 pounds per square foot (psf). The foundations should bear at a minimum depth of 18 inches below the proposed final exterior grade in the medium to stiff naturally occurring soils or newly placed compacted fill material.

The following sections provide additional detailed recommendations. The recommendations presented herein have been developed on the basis of the subsurface conditions encountered during field investigation and our understanding of the proposed construction. Should changes in the project criteria occur, a review must be carried out by GMC to determine if modifications to our recommendations will be required.

2.0 PROJECT INFORMATION AND SCOPE OF WORK

2.1 Project Information

A geotechnical exploration has been conducted for the proposed Alabama Department of Human Resources (DHR) Office Building to be located on Prevatt Road in Dothan, Houston County, Alabama. The proposed site is currently adjacent (east) to the existing DHR Office Building which is located at the southwest corner of U.S. 431 and Prevatt Road.

We have been provided with a preliminary site outline; however, detailed grading and structural information have not been provided at the time of this report. The site has been previously developed and is relatively level. We understand that the proposed office building will be approximately 45,000 square feet. We anticipate future building and parking grades to be within approximately 5 feet of current site elevations. Likewise, we have assumed maximum column and wall loads of 150 kips and 4 kips/foot, respectively, and construction will be masonry (CMU) type with steel joists.

2.2 Scope of Work

The purpose of this exploration was to perform a general evaluation of the subsurface soil conditions at the site and to provide general sitework, pavement, and foundation recommendations. The scope of the exploration and evaluation included drilling a total of seventeen (17) soil test borings. Six (6) borings were drilled in the proposed building footprint to a depth of 20 feet each. Eleven (11) borings were drilled in the planned parking areas to a depth of 10 feet each. It also included an engineering evaluation of the materials encountered.

The scope of services for the geotechnical study did not include any environmental assessment for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site. Any statements in this report or on the boring records regarding odors, colors, or unusual or suspicious items or conditions are strictly for the information of the client.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

3.1 Field Exploration

The boring locations and depths were selected by GMC personnel. Field testing employed by GMC was performed in general accordance with ASTM standards or generally accepted methods. The borings were located in the field by GMC personnel.

The borings were performed on August 13, 2025 using a Geoprobe 7822 drill rig equipped with a rotary head and hollow stem augers (HSA). Soils were sampled using a two-inch OD split barrel sampler in accordance with ASTM D1586 driven with an automatic hammer.

3.2 Laboratory Testing

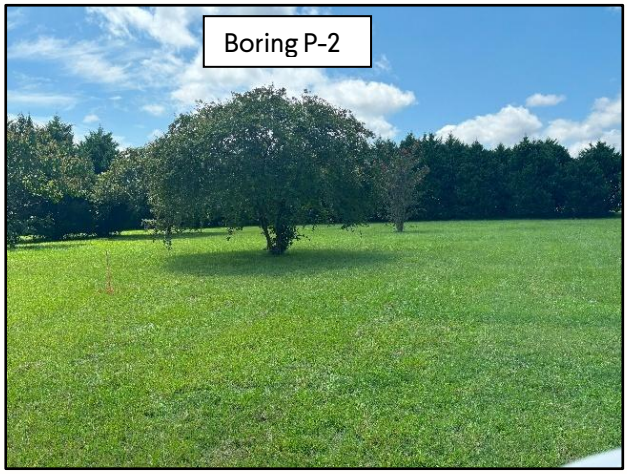
The laboratory testing program included visual classification of all soil samples and laboratory tests consisting of natural moisture contents, grain size analyses, and Atterberg limits tests. The laboratory testing program was conducted in accordance with applicable ASTM Standards, and the results are indicated on the Boring Records and summarized in the Appendix.

4.0 SITE AND SUBSURFACE CONDITIONS

4.1 General

At the time of this study, the proposed site was located on the south side of Prevatt Road approximately 700 feet east of its intersection with U.S. 431. The site currently includes a residential house with typical landscaping as well as other landscaped areas including short grasses and trees/bushes. The site slopes gently downward from the northwest corner to the southeast corner. Current topographic maps indicate site elevations range from EL 332 feet (SE Corner) to EL 345 feet (NW Corner). The photos below show the site at the time of our investigation.





4.2 Site Geology

Published geologic information indicates that the site is underlain by Residuum consisting of the Claiborne/Jackson Group of the Eocene-Oligocene Age. The primary constituency of this formation is clay or mud, with others consisting of sand, limestone, and chert. White to moderate-reddish-orange locally mottled sandy clay and residual clay with scattered layers of gravelly medium to coarse sand, fossiliferous chert and limestone boulders and limonitic sand masses are observed.

4.3 Subsurface Conditions

Surficial Materials
The borings initially encountered 4 to 9 inches of organic laden material (topsoil) across the site.

Existing Fill Materials
The borings predominantly encountered approximately 2 to 3 feet of existing fill material generally classified very loose to medium silty sand (SM). Standard Penetration Test (SPT) N-Values in these materials ranged from 0 to 10 blows per foot (bpf). It is likely that this material was placed during the original construction and grading of the existing residential house lot.

Residual Materials
Below the existing fill materials, the borings typically encountered varying layers of very loose to dense clayey sand (SC) and very soft to hard sandy lean clay (CL) to the boring termination depths. The borings generally

encountered soils with more clay and higher consistency with increasing depth below the surface. SPT N-Values in these materials ranged from 2 to 35 bpf. Auger refusal was not encountered in the borings.

The subsurface descriptions contained herein are of a generalized nature to highlight the major soil stratification features and soil characteristics. The boring records included in the Appendix should be reviewed for specific information as to individual boring location. The stratification shown on the boring records represents conditions only at the actual boring location. Variations may occur and should be expected across the site. The stratifications represent the approximate boundary between subsurface materials, and the transition may be gradual.

4.4 Groundwater Information

Groundwater was not encountered in the borings at the time of drilling. The borings were backfilled prior to leaving the site for safety reasons and therefore no long-term groundwater levels were recorded. It is important to note that the groundwater levels may not have stabilized in the borings. Furthermore, groundwater levels may vary due to seasonal conditions and recent rainfall.

5.0 SITEWORK RECOMMENDATIONS

5.1 General

The site should be suitable for development, provided it is prepared herein. The main development issue for this site will be the low consistency soils (SPT N-values ‹ 8 bpf) and existing fill in the upper 4 to 6 feet of the site. These soils should be remediated by removal and either replacement or recompaction to provide a suitable subgrade for foundations, slab support, and pavements.

5.2 Sitework Recommendations

Clearing and Stripping

Sitework should begin with clearing and grubbing of the site and should include the removal of the organic laden material, deleterious material, and asphalt pavement. All existing underground utilities and foundations to be abandoned in the planned construction areas should be removed and properly backfilled with structural fill material. We recommend a minimum of 10-inches of stripping be budgeted for this site.

Low Consistency Soils

The borings encountered existing fill materials and residual soils consisting of very loose to loose clayey and silty sands (SC and SM) and very soft to soft sandy lean clay (CL) in the upper 4 to 6 feet of the site. These soils, if left in place, could result in settlement of foundations and pavements above generally acceptable tolerable limits.

If foundations or pavements are to be located in these materials, we recommend these soils be evaluated and remediated to provide a stable bearing surface. Loose or soft soils may be moisture conditioned and compacted per Section 5.5 of this report or undercut to suitable material. All subgrade soils should be evaluated by a geotechnical engineer or his representative to determine suitability prior to fill placement or building construction. **We recommend an allowance for the removal and replacement of approximately 4 feet of unsuitable materials within the building footprint and 2 feet within the pavement areas be included in the bid documents.** The undercut area should extend ten (10) feet in the building and five (5) feet beyond the parking

areas. Prior to undercutting, the site should be stripped and cut to the subgrade elevation, compacted, and proofrolled as noted below.

Undercut soils may be stockpiled and re-used as structural fill material, if they are free of deleterious materials and meet the specifications of Section 5.5 of this report. We anticipate that these soils will require moisture conditioning to be able to be reused. Additional testing of these soils would be required.

Proofrolling

Once the site is at grade and prior to the placement of any new fill, the areas should be proofrolled with repeated passes of a loaded tandem axle dump truck to locate deeper soft soils. Soils that are observed to rut or deflect excessively under the moving load should be undercut and replaced with properly compacted fill. The proofrolling, undercutting, and filling activities should be witnessed by a qualified representative of the geotechnical engineer and should be performed during a period of dry weather.

We anticipate that recompaction of the surface soils will be required. Attempts can first be made to compact the problem soils. If dry weather conditions exist prior to and at the time of construction, re-compaction and densification may prove successful. The soils should be scarified and the soil moisture should be adjusted to within 3 percent of optimum moisture for low plasticity soils. Once proof rolling has been accomplished, then re-compaction of the soils may be attempted. In pavement areas where unsuitable soils are encountered, stabilization using geotextile or geogrid with stone may be a more economical option than removal and replacement of the soils.

5.3 Time of Year Site Preparation Considerations

The time of the year that the sitework begins can affect the project considerably. In this area, the "wet" season is generally between the months of November to April, and the "dry" season from May to October. There are many considerations that need to be addressed prior to bidding a project that could affect the budget based on the time of year a project starts earthwork activities. The time of the year that the geotechnical borings were performed can provide a false sense of actual near surface conditions depending on the time of year and weather conditions. Below are considerations that should be addressed based on the time of the year earthwork is started.

"Wet" Season

During the "wet" season, the amount of undercutting may be greater, therefore resulting in greater excavation costs. The soils are typically proofrolled to determine their suitability for the placement of new fill or subgrade support. During the wet season, the surface soils have a higher moisture content and will tend to pump, therefore, hindering the placement of new fill. In addition, the drying time, time period between rain events, and temperature is not conducive to scarify soils, allow to dry, and recompact. At this time, the decision should be made by the owner to try either scarify/dry/compact the in-place soils, which could take time, or undercut and replace with suitable material, which could increase the sitework costs. Based on our experience, the amount of undercut could be an additional 1 to 2 feet (or greater in localized areas), whereas in drier weather, lesser amounts of undercutting may be necessary, if recompaction or stabilization of soils left in place can be achieved.

Some undercut soils are not always "unsuitable" soil and can be moisture conditioned and reused as fill in the deep areas if drying conditions are favorable.

"Dry" Season

During the "dry" season, the surface soils have a lower moisture content and will tend to "bridge" or "crust" softer underlying soils. They will generally allow the placement of new fill, but the crust can break down if repeated passes with heavily loaded equipment is persistent. In addition, new fill from cuts or other sources may need to be moisture conditioned prior to compaction. The soils can dry significantly, requiring the addition of water for proper compaction. Water trucks should be used, as necessary, by the contractor to condition the soils within the required specifications.

Contractor Responsibility

The grading contractors have the option of performing their own evaluation of the site conditions to assess the excavation considerations based on the time of year a project is bid. We strongly suggest that the grading contractors conduct their own exploration and evaluation of the site conditions and material management requirements to cost effectively develop the site.

Typically, due to the movement of heavy equipment and weather conditions, the subgrade becomes disturbed during construction. As a result, fine grained clayey soils tend to lose shear strength and support capability. Therefore, additional effort on the Contractor's part will be required to reduce traffic and limit disturbance of soils. It is essential that the subgrade be restored to a properly compacted condition based on optimum moisture and density requirements. Restoration of the subgrade should be addressed in the project specifications.

5.4 Drainage Considerations

Adequate drainage should be provided at the site to reduce the increase in moisture content of the foundation soils. We recommend that the parking lots, walkways, and the ground surface be sloped away from the structure on all sides. Roof drainage should be collected by gutters and downspouts and transmitted by pipe to the storm water drainage system or discharge a minimum of 5 feet away from the building.

5.5 Fill Placement

Soil Fill Material

Soil fill material should be placed in loose lifts not exceeding 8-inches in thickness with a maximum particle size of 3 inches. The following table summarizes the compacted fill requirements:

Location	Test Method	Compaction Required (minimum)	Moisture Content
Structural Areas and 10' beyond perimeter	ASTM D698 (standard)	98 %	-/+3 percentage points of optimum moisture
Parking and Drive Areas and 5' beyond the curb	ASTM D698 (standard)	98 %	-/+3 percentage points of optimum moisture

Structural fill material should meet the following characteristics:

Property	Requirement
Organic Material	≤ 5%
Liquid Limit	‹ 50%
Plasticity Index	≤ 25%
Maximum Dry Density	≥ 100 lb/ft^3
Maximum Particle Size	3 inches or less

Samples of the proposed fill materials, either from on-site or borrow, should be provided to the geotechnical engineer for Proctor testing and evaluation prior to placement. The on-site soils (classified as SC and CL) should be suitable for reuse as structural fill material but may need to be moisture conditioned. Density tests should be performed to document compaction and moisture content of any earthwork involving soils and other applicable materials. Density tests should be performed frequently, with a recommended minimum of one test per 5,000 square feet per lift of fill in structural areas and one test per 10,000 square feet per lift in other areas. Fill material must meet the specified density and moisture requirements to be considered acceptable.

5.6 Backfilling of Utility Trenches

Backfilling of storm drain and utility trenches must be performed in a controlled manner to reduce settlement of the fill and cracking of overlying floor slabs and pavements. We recommend that utility trenches be backfilled with acceptable borrow or dense-graded crushed stone in 6-inch loose lifts compacted with mechanical piston tampers to the project requirements. Should seepage occur in utility trenches, it may be necessary to "floor" the trench with dense-graded gravel to provide a working surface. If crushed stone is used to backfill utility trenches, we recommend that dense graded aggregate (DGA, compacted in lifts) be used. Open-graded crushed stone, such as ALDOT #57, can serve as a channel for seepage toward structures and therefore is not recommended for use as utility trench backfill within 5 feet of the building's exterior perimeter and under pavements and drives.

5.7 Subgrade Restoration

Typically, due to the movement of heavy equipment and weather conditions, the subgrade soil becomes disturbed during construction. As a result, these soils tend to lose shear strength and support capability. Therefore, additional effort on the contractor's part will be required to reduce traffic and limit disturbance of soils. It is essential that the subgrade be restored to a properly compacted condition based on optimum moisture and density.

6.0 STRUCTURAL RECOMMENDATIONS

6.1 Shallow Foundations

If the site is prepared as above, column and wall foundations can be supported on shallow foundations. We recommend that conventional shallow foundations should be sized for a maximum allowable bearing capacity of 2,000 pounds per square foot (psf). The foundations should bear at a minimum depth of 18 inches below the proposed final exterior grade in the medium to stiff naturally occurring soils or newly placed compacted fill material. Based on the assumed building loads we anticipate post-construction settlements of 1-inch for total and ½-inch for differential settlement over a distance of 50 feet.

Even though computed footing dimensions may be less, column footings and continuous footings should have minimum width dimensions of 24 inches and 18 inches, respectively. This allows for hand cleaning of materials disturbed during the excavation process and reduces the potential for punching shear failure.

Foundation concrete should be placed the same day as footings are excavated so that the foundation bearing soils can remain near the existing moisture content. Foundation bearing surfaces should not be disturbed or left exposed during inclement weather. Saturation of the on-site soils can cause a loss of strength and increased compressibility. If bearing soils dry excessively, the can later well and heave foundations. Excavations for footings should be hand cleaned to remove loose soil or mud and the bearing surface should be thoroughly compacted. If concrete placement is not possible immediately after excavation, we recommend that a thin layer (approximately 2 inches) of lean concrete or CLSM be placed on the bearing surface for protection after we have observed and evaluated the exposed bearing surfaces.

All foundation excavations should be observed by the geotechnical engineer or his representative. The engineer can provide geotechnical guidance to the owner's design team should any unforeseen foundation problems develop during construction. If areas of foundation surfaces prove to be unsuitable, the foundation may need to be over-excavated. The over-excavated area can be backfilled with "lean" concrete, controlled low strength material (CLSM), or well-compacted dense graded crushed stone (ALDOT 825B) up to the planned foundation bearing depth.

6.2 Floor Slabs

It is our opinion that floor slabs can be built on-grade achieving support from properly compacted fill material or approved existing subgrade. For select fill subgrade soils compacted to at least 98 percent of the materials standard Proctor maximum dry density, we recommend a modulus of subgrade reaction of 125 psi/in (pci). Ground supported slabs should be founded on a minimum of 4 inches of compacted, granular materials such as crushed stone or a clean sand with less than 10% passing the #200 sieve. This layer should provide uniform and immediate support of the slab and act as a capillary break. A vapor retarder should be used on top of the granular layer, as required by the building use.

Care should be taken so that fines from the subgrade are not allowed to contaminate the granular layer. If fines do contaminate this layer, capillary rise and subsequent damage to moisture sensitive floor coverings could occur. On most projects, there is some time lag between initial grading and the time when the contractor is ready to place concrete for the slab-on-grade. Inclement weather just prior to placement of concrete for the slab-on-grade can result in trapped water in the granular layer.

6.3 Seismic Site Classification

Subsurface information (SPT and soil classification) from the borings, published geologic information, and our experience was used to estimate the seismic site classification according to methods in the 2021 International Building Code. Based upon this information, we recommend a Seismic Class of **D (Stiff Soil)** for this site. The design responses for the short 0.2-sec (S_{DS}) and 1-second period (S_{D1}) are included in the following table. The responses are modeled on the ASCE Hazard Tool (https://ascehazardtool.org) for the site located at approximate Latitude 31.195011 and an approximate Longitude -85.370993. Based on our understanding of the project, we have assumed a Rick Category of **III**. If the Risk Category is different, the values below may need to be revised.

Period (sec)	Mapped Spectral Response Accelerations (g)		Values of Site Coefficient for Site Class		Maximum Spectral Response Acceleration Adjusted for Site Class (g)		Design Spectral Response Acceleration (g)	
0.2	S_S	0.082	F_a	1.6	S_{MS}	0.132	S_{DS}	0.088
1.0	S_1	0.058	F_v	2.4	S_{M1}	0.139	S_{D1}	0.093

Reference: ASCE Hazard Tool (https://ascehazardtool.org)

7.0 PAVEMENTS

7.1 General

We have not been provided with traffic information at the time of this report; however, based on similar projects of this type, we assume that typical traffic will include passenger vehicles and occasional delivery and garbage trucks. If this traffic information changes, it should be provided to us for review and, if necessary, to make changes to pavement recommendations and sections herein.

Based on the existing site conditions and planned use, we recommend that a flexible pavement be utilized in the parking and drive lanes and a rigid pavement in the area of the dumpster pad and any loading areas.

7.2 Subgrade

The pavement subgrades should be thoroughly proofrolled prior to fine grading to identify loose or soft soils not encountered during the mass grading of the site. Any loose or soft areas should be remediated as outlined in Section 5.0 of this report. **Undercut of loose/soft materials and either recompaction or replacement with structural fill should be budgeted for the 2 feet underlying the pavements per Section 5.2 of this report. If pavement areas require further stabilization, an additional option of geotextile and stone should also be considered and budgeted as well.**

Typically, during construction, the pavement subgrade becomes disturbed because of traffic and environmental conditions. Prior to construction of pavements, it is essential that the subgrade be restored to a properly compacted condition. The specifications should include notes pertaining to subgrade restoration immediately prior to pavement construction. The on-site clayey soils will tend to lose shear strength (and consequently pavement support capability) if they are exposed to excessive moisture. Thus, proper moisture conditioning of the subgrade prior to placement of the pavement base course will result in better pavement performance.

7.3 Rigid Pavement

All Portland cement concrete pavements should contain 4 to 6 percent entrained air assuming the mix will contain ¾ -inch to 1-inch nominal maximum size aggregate. The concrete slump should be no more than 2 inches when placed by slip forming and no more than 4 inches for non-slip formed concrete. Minimum 28-day concrete compressive strength should be 4,000 psi and minimum flexural strength 650 psi.

Pavement Area	Minimum Section Thickness	Pavement Materials
Standard Duty Pavements	5.0 inches	ALDOT Section 450A Concrete Pavement
	4.0 inches (1)	ALDOT Section 825 Type B, Dense Graded Aggregate Base (100% Modified)
Heavy Duty Pavements	6.0 inches	ALDOT Section 424A Superpave Bituminous Wearing Surface
	4.0 inches (1)	ALDOT Section 825 Type B, Dense Graded Aggregate Base (100% Modified)

(1) In lieu of crushed aggregate base course (ALDOT 825 Type B), soil aggregate base course (ALDOT 823 Type B or C) can be utilized with a thickness of 8 inches for Standard Duty and Heavy Duty pavement sections.

Pavement joints, reinforcing, and details should be designed in accordance with the applicable American Concrete Institute (ACI) standards. Portland cement concrete pavement should meet the requirements of ALDOT Section 450.

7.4 Flexible Pavement

The typical minimum flexible pavement sections should include the following:

Pavement Area	Minimum Section Thickness	Pavement Materials
Standard Duty Pavements	1.0 inch	ALDOT Section 424A Superpave Bituminous Wearing Surface
	2.0 inches	ALDOT Section 424B Superpave Bituminous Binder Layer
	6.0 inches (1)	ALDOT Section 825 Type B, Dense Graded Aggregate Base (100% Modified)
Heavy Duty Pavements	1.5 inches	ALDOT Section 424A Superpave Bituminous Wearing Surface
	3.0 inches	ALDOT Section 424B Superpave Bituminous Binder Layer
	6.0 inches (1)	ALDOT Section 825 Type B, Dense Graded Aggregate Base (100% Modified)

(1) In lieu of crushed aggregate base course (ALDOT 825 Type B), soil aggregate base course (ALDOT 823 Type B or C) can be utilized with a thickness of 9 inches for Standard Duty and Heavy Duty pavement sections.

A prime coat (ALDOT Section 401) should be placed on the dense graded aggregate prior to bituminous binder layer placement. A tack coat (ALDOT Section 405) should be placed between bituminous pavement layers. The pavement sections represent the minimum recommended thickness for a pavement section designed for a 20-year life. However, periodic maintenance should be anticipated over the pavement design life. All pavement materials and construction procedures should conform to the *State of Alabama Department of Transportation Standard Specifications for Highway Construction, Latest Edition*. The hot-mix asphalt should conform to Section 424.

8.0 REPORT LIMITATIONS

The recommendations submitted are based on the available soil information obtained by GMC and design details furnished by GMC for the proposed project. Additional borings should be drilled at the site to help characterize the subsurface conditions. In addition, building and loading condition specific geotechnical explorations should be performed for individual building sites so that site-specific recommendations can be provided.

The recommendations submitted are based on the available soil information obtained by GMC and design details furnished by GMC for the proposed project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, we should be notified immediately to determine if changes in the foundation, or other, recommendations are required. If GMC is not retained to perform these functions, GMC cannot be responsible for the impact of those conditions on the performance of the project.

The findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

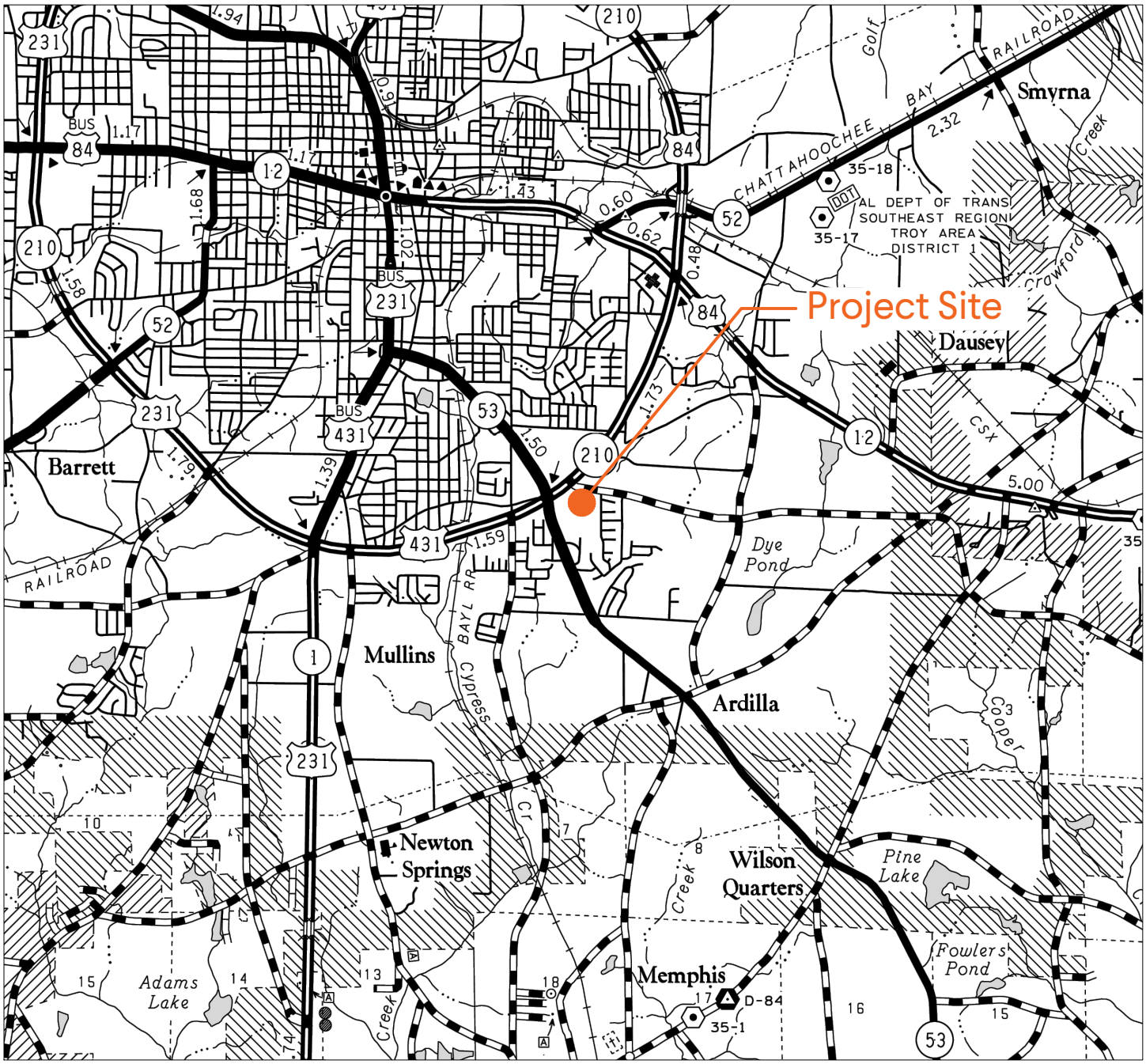
After the plans and specifications are more complete, the geotechnical engineer should be provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At that time, it may be necessary to submit supplementary recommendations.

We emphasize that this report was prepared for design and informational purposes only and may not be sufficient to prepare an accurate construction budget. Contractors reviewing this report should acknowledge that the recommendations contained herein are for design and informational purposes only. In no case should this report be utilized as a substitute for the development of specific earthwork specifications.

The information contained in this report is not intended, nor is sufficient, to aid in the design of segmental or mechanically stabilized earth (MSE) retaining walls. Segmental or MSE wall designers and builders should not rely on this report and should perform independent analysis to determine all necessary soil characteristics for use in their wall design, including but not limited to, soil shear strengths, bearing capacities, global stability, etc.

APPENDIX

Figure 1 – Site Location Map
Figure 2 – Site Geology Map
Figure 3 – USGS Site Map
Figure 4 – Boring Location Plan
Soil Classification Chart
Subsurface Diagrams
Boring Records
Summary of Laboratory Results
Field and Laboratory Procedures



Reference: General Highway Map of Houston County, ALDOT, 2017

DHR Houston County
Dothan, Alabama

Site Location Map

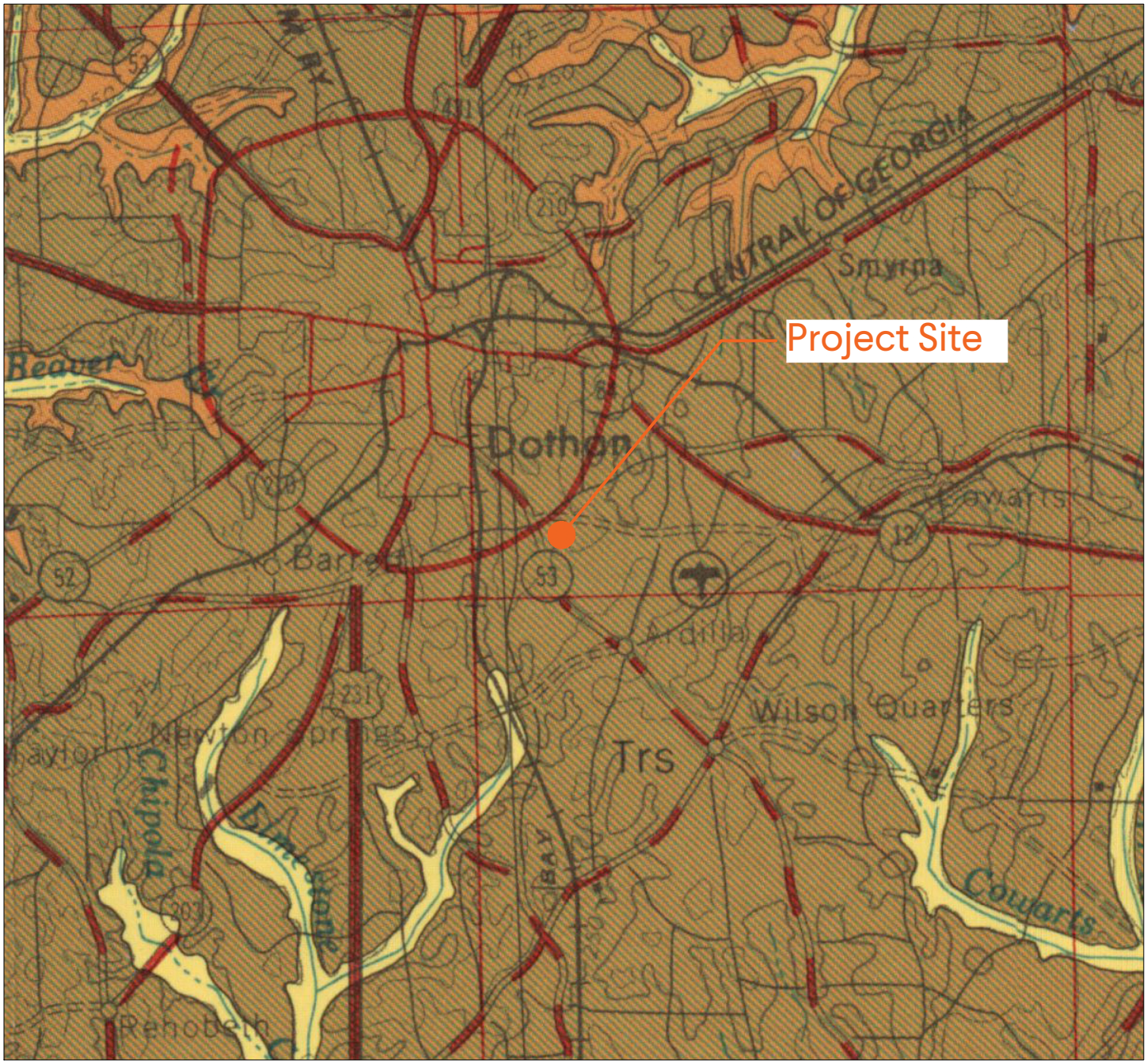
Figure 1

SUPPLEMENTAL DRAWING

GMC # GMGM250037
08/29/2025
DRAWN BY: DDG

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GMC



Trs **Residuum (Claiborne/Jackson Group) -** White to moderate-reddish-orange locally mottled sandy clay and residual clay with scattered layer of gravelly medium to coarse sand, fossiliferous chert and limestone boulders and limonitic sand masses.

Reference: Szabo, M.W., and Copeland, C.W. Jr., 1988, Geologic Map of Alabama, Geological Survey of Alabama Special Map 220

DHR Houston County
Dothan, Alabama

Site Geology Map

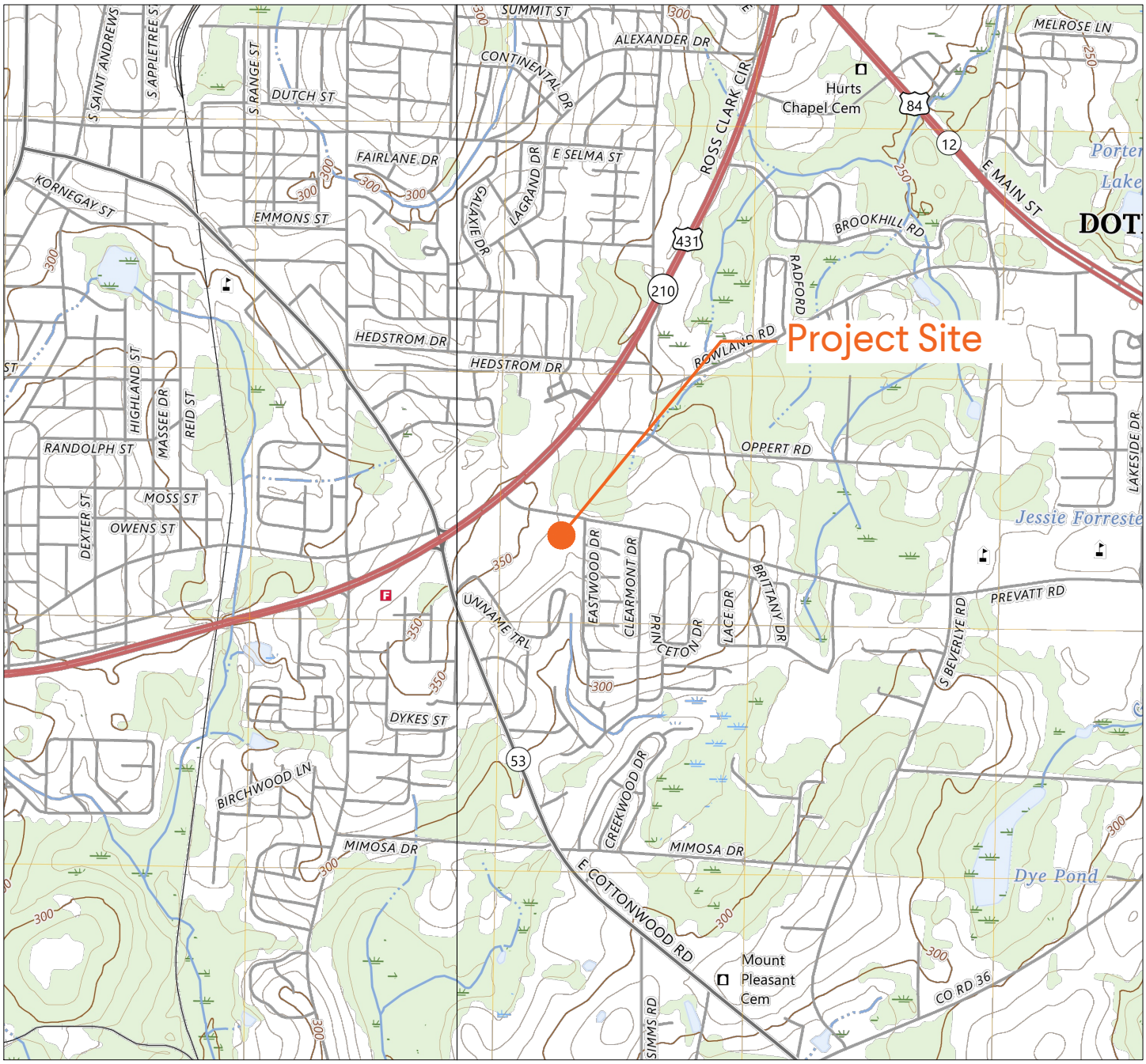
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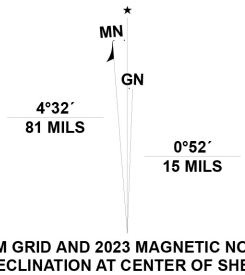
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UTM GRID AND 2023 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET



QUADRANGLE LOCATION

Reference: USGS Quadrangles 7.5 Minute Series (Topographic)

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Dothan, Alabama

Dothan East (2024) | Dothan West (2024)
USGS Site Map

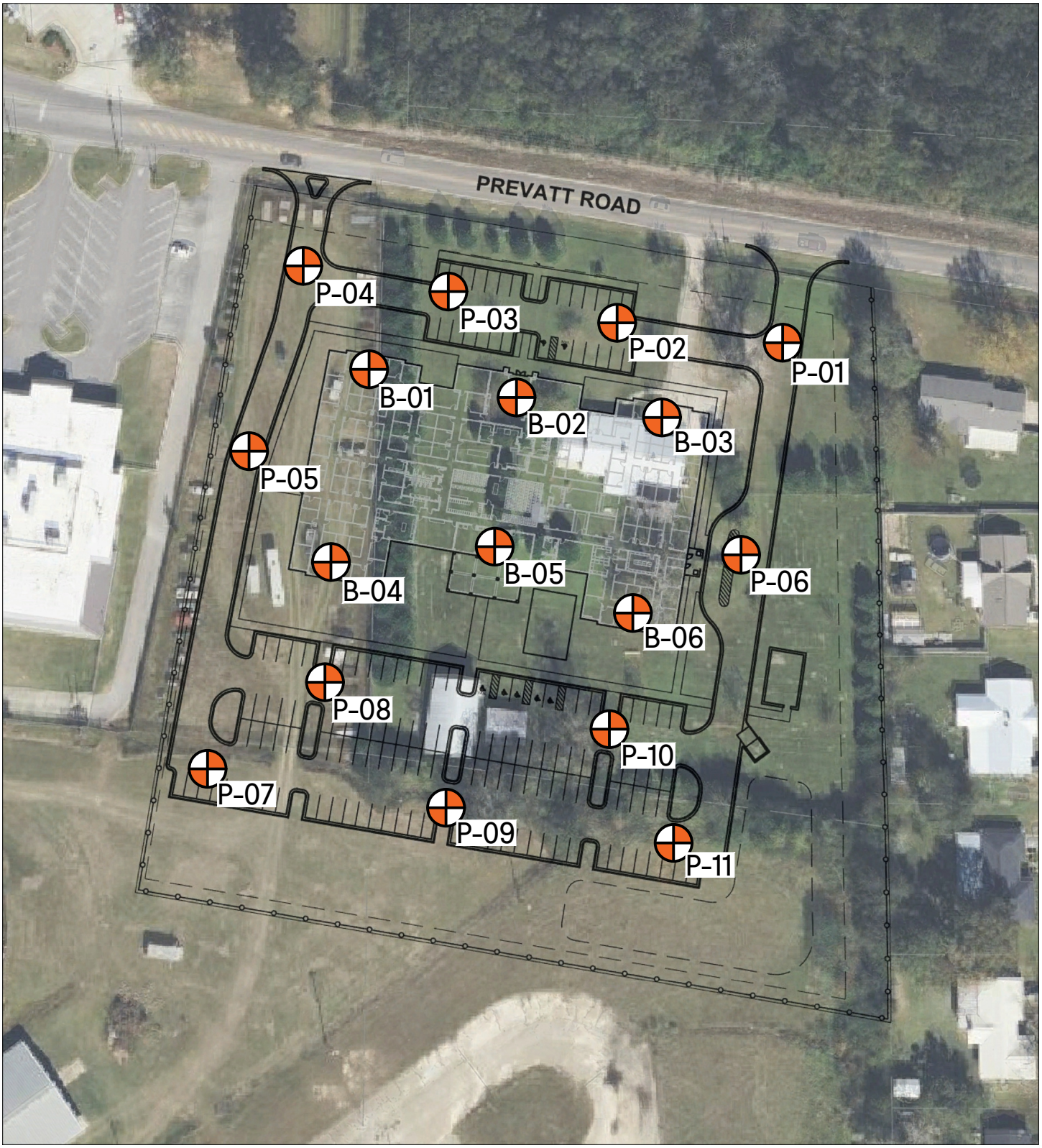
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SUPPLEMENTAL DRAWING

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Approximate Boring Location

Reference: GMC drawing adapted from Google Earth Imagery with Preliminary Site Plan Overlay

DHR Houston County
Dothan, Alabama

Boring Location Plan

Figure 4

SUPPLEMENTAL DRAWING

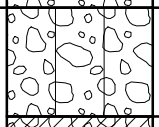
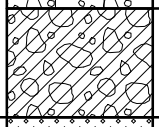
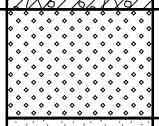
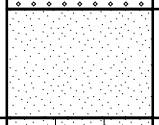
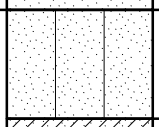
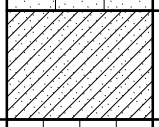
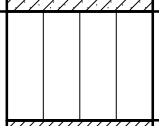
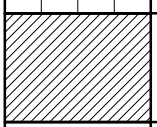
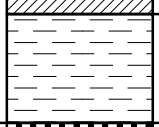
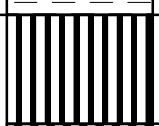
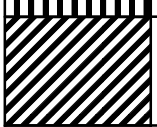
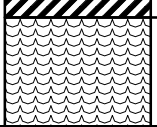
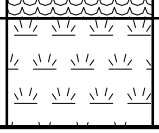
GMC # GMGM250037
08/29/2025
DRAWN BY: DDG

2660 East Chase Lane, Suite 200
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GMC

GMC

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

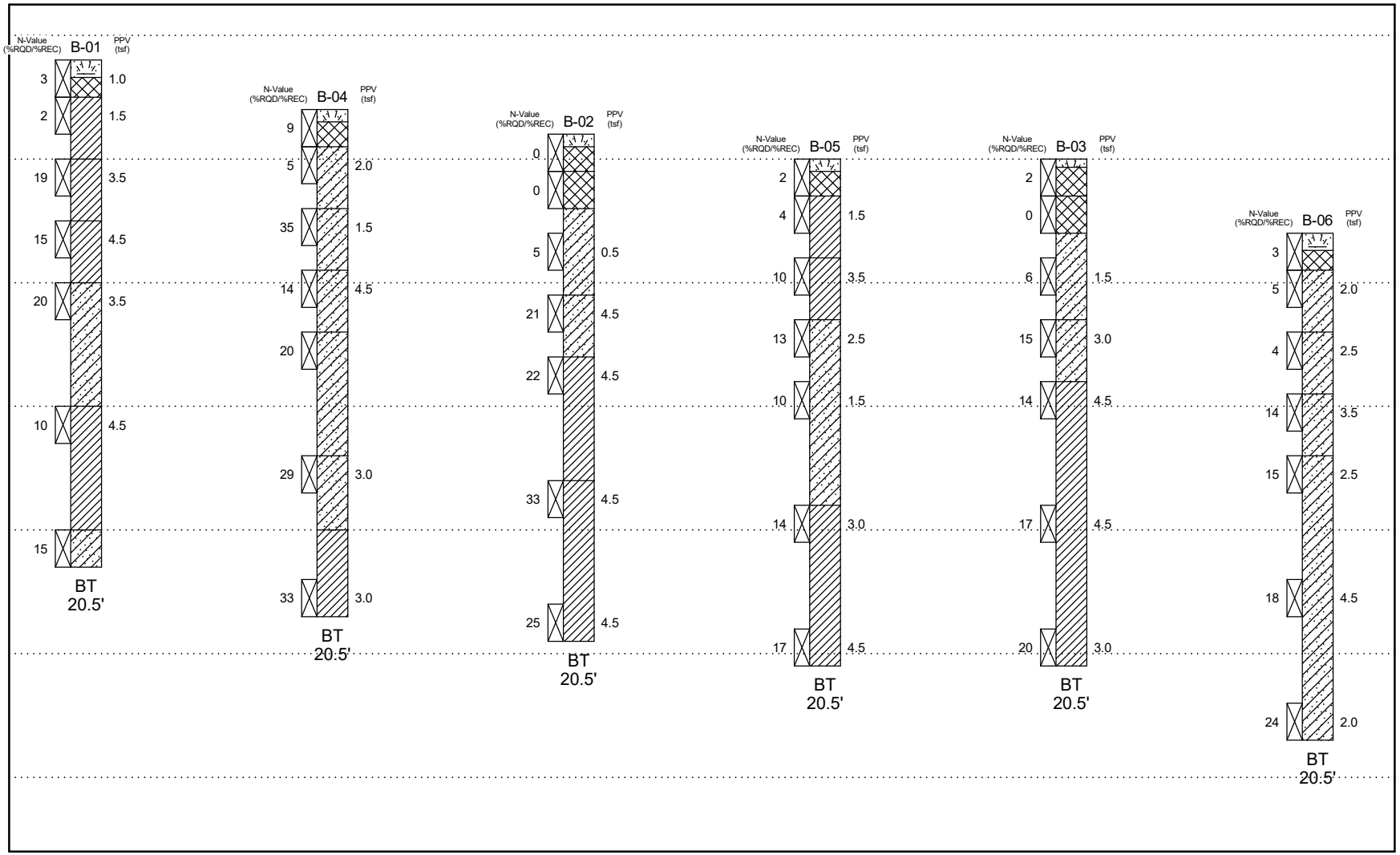
NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SUBSURFACE DIAGRAM A-A'

TOPSOIL FILL CL SC

CLIENT Houston County Commission **PROJECT NAME** DHR Houston County

PROJECT NUMBER GMGM250037 **PROJECT LOCATION** Dothan, AL



BT - Boring Termination
AR - Auger Refusal

Distance Along Baseline (ft)

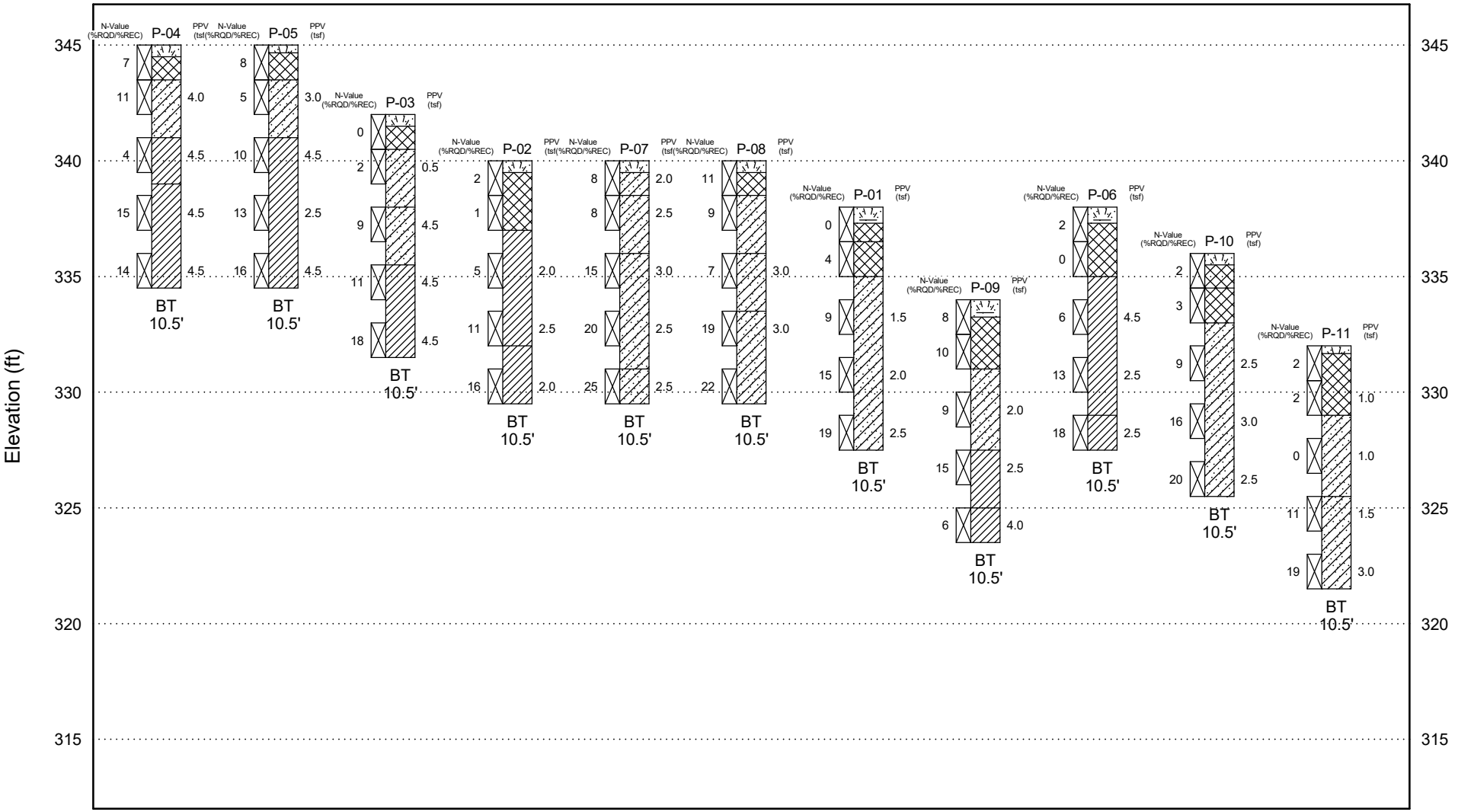
BT-AR DEPTH LOG GMGM250037 DHR HOUSTON COUNTY.GPJ GMC DATA TEMPLATE.GDT 9/5/25

SUBSURFACE DIAGRAM
B-B'

TOPSOIL FILL SC CL

CLIENT Houston County Commission **PROJECT NAME** DHR Houston County

PROJECT NUMBER GMGM250037 **PROJECT LOCATION** Dothan, AL



BT - Boring Termination
AR - Auger Refusal

Distance Along Baseline (ft)

BT-AR DEPTH LOG GMGM250037 DHR HOUSTON COUNTY.GPJ GMC DATA TEMPLATE.GDT 9/5/25

BORING NUMBER B-01

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 344 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 7"										
			SILTY SAND (SM), reddish brown, very loose, w/ organics - FILL	SS		1-2-1 (3)	1.0		15				
			SANDY LEAN CLAY (CL), orangish brown, very soft	SS		1-1-1 (2)	1.5		15				
340													
	5		SANDY LEAN CLAY (CL), light brown, very stiff	SS		6-9-10 (19)	3.5		20				
			SANDY LEAN CLAY (CL), light gray, stiff	SS		5-7-8 (15)	4.5		20				
335													
	10		CLAYEY SAND (SC), pink, medium	SS		6-9-11 (20)	3.5						
330													
	15		SANDY LEAN CLAY (CL), light pink, stiff	SS		5-5-5 (10)	4.5						
325													
	20		CLAYEY SAND (SC), light pink, medium	SS		6-7-8 (15)							
			Boring was terminated at 20.5 feet.										
320													
	25												

BORING NUMBER B-02

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 341 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 5"										
340			SILTY SAND (SM), dark brown, very loose, w/ organics - FILL	SS		1-0-0 (0)			14				
			SILTY SAND (SM), light brown, very loose - FILL	SS		0-0-0 (0)			10				
			CLAYEY SAND (SC), pale brown, reddish brown, loose										
	5			SS		2-2-3 (5)	0.5		16	27	15	12	36
335													
			CLAYEY SAND (SC), reddish brown, light gray, medium	SS		8-10-11 (21)	4.5		21				
	10		SANDY LEAN CLAY (CL), light gray, pinkish brown, very stiff to hard	SS		6-10-12 (22)	4.5						
330													
	15			SS		12-15-18 (33)	4.5						
325													
	20			SS		12-13-12 (25)	4.5						
320			Boring was terminated at 20.5 feet.										
	25												

BORING NUMBER B-03

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 340 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
340	0		Organic Laden Material (OLM), 4"										
			SILTY SAND (SM), dark brown, very loose, w/ organics - FILL	SS		1-1-1 (2)			13				
			SILTY SAND (SM), light brown, very loose - FILL	SS		0-0-0 (0)			7				
			CLAYEY SAND (SC), light brown, loose										
335	5			SS		2-2-4 (6)	1.5		13				
			CLAYEY SAND (SC), light brown, medium	SS		6-6-9 (15)	3.0		15				
330	10		SANDY LEAN CLAY (CL), pinkish brown, orangish brown, stiff to very stiff	SS		7-7-7 (14)	4.5						
325	15			SS		7-8-9 (17)	4.5						
320	20			SS		8-9-11 (20)	3.0						
			Boring was terminated at 20.5 feet.										
315	25												

BORING NUMBER B-04

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 342 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 6"										
			SILTY SAND (SM), dark brown, loose, w/ organics - FILL	SS		4-5-4 (9)			15				
340			CLAYEY SAND (SC), medium brown, loose	SS		3-2-3 (5)	2.0		12	23	11	12	35
	5		CLAYEY SAND (SC), medium brown, dense	SS		12-15-20 (35)	1.5		15				
335			CLAYEY SAND (SC), light brown, pink, medium	SS		7-7-7 (14)	4.5		12				
	10		CLAYEY SAND (SC), pale brown, medium	SS		6-9-11 (20)							
330													
	15		CLAYEY SAND (SC), pink, pale brown, medium	SS		12-13-16 (29)	3.0						
325			SANDY LEAN CLAY (CL), pink, pale brown, hard										
	20			SS		13-14-19 (33)	3.0						
			Boring was terminated at 20.5 feet.										
320													
	25												

BORING NUMBER B-05

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 340 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
340	0		Organic Laden Material (OLM), 6"										
			SILTY SAND (SM), dark brown, very loose, w/ organics - FILL	SS		1-1-1 (2)			11				
			SANDY LEAN CLAY (CL), light brown, soft	SS		1-2-2 (4)	1.5		14				
335	5		SANDY LEAN CLAY (CL), pink, pale brown, stiff	SS		2-4-6 (10)	3.5		14				
			CLAYEY SAND (SC), pink, light brown, medium to loose	SS		4-5-8 (13)	2.5		12				
330	10			SS		4-5-5 (10)	1.5						
325	15		SANDY LEAN CLAY (CL), pink, white, stiff to very stiff	SS		6-6-8 (14)	3.0						
320	20			SS		7-8-9 (17)	4.5						
			Boring was terminated at 20.5 feet.										
315	25												

BORING NUMBER B-06

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 337 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 7"										
			SILTY SAND (SM), dark brown, very loose, w/ organics - FILL	SS		1-1-2 (3)			13	NP	NP	NP	20
335			CLAYEY SAND (SC), brown, loose, w/ trace organics	SS		2-3-2 (5)	2.0		12				
	5		CLAYEY SAND (SC), brown, very loose	SS		2-2-2 (4)	2.5		16				
330			CLAYEY SAND (SC), brown, medium	SS		4-5-9 (14)	3.5		18				
	10		CLAYEY SAND (SC), brown, reddish brown, gray, medium	SS		6-7-8 (15)	2.5						
325													
	15			SS		8-8-10 (18)	4.5						
320													
	20			SS		11-12-12 (24)	2.0						
315			Boring was terminated at 20.5 feet.										
	25												

BORING NUMBER P-01

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 338 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 7"										
			SILTY SAND (SM), dark brown, very loose, w/ organics - FILL	SS		1-0-0 (0)			10				
335			SILTY SAND (SM), brown, very loose, w/ trace organics - FILL	SS		1-2-2 (4)			9				
			CLAYEY SAND (SC), brown, loose to medium										
	5			SS		3-4-5 (9)	1.5		16				
330				SS		6-7-8 (15)	2.0						
	10			SS		7-9-10 (19)	2.5						
			Boring was terminated at 10.5 feet.										
325													
	15												
320													
	20												
315													
	25												

1.GMC BORINGS GMGM250037 DHR HOUSTON COUNTY.GPJ GMC DATA TEMPLATE.GDT 9/8/25

BORING NUMBER P-02

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 340 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
340	0		Organic Laden Material (OLM), 5"										
			SILTY SAND (SM), dark brown, very loose - FILL	SS		1-1-1 (2)			11				
				SS		1-1-0 (1)			6				
			SANDY LEAN CLAY (CL), brown, medium to stiff										
335	5			SS		2-2-3 (5)	2.0		14				
				SS		6-6-5 (11)	2.5						
			SANDY LEAN CLAY (CL), brown, very stiff										
330	10			SS		8-8-8 (16)	2.0						
			Boring was terminated at 10.5 feet.										
325	15												
320	20												
315	25												

BORING NUMBER P-03

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 342 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 5"										
			SILTY SAND (SM), dark brown, very loose, w/ organics - FILL	SS		0-0-0 (0)			14				
340			CLAYEY SAND (SC), brown, very loose	SS		1-1-1 (2)	0.5		14				
	5		CLAYEY SAND (SC), pink, white, loose	SS		2-4-5 (9)	4.5		15				
335			SANDY LEAN CLAY (CL), pale brown, white, stiff to very stiff	SS		5-5-6 (11)	4.5						
	10			SS		6-7-11 (18)	4.5						
			Boring was terminated at 10.5 feet.										
330													
	15												
325													
	20												
320													
	25												

BORING NUMBER P-04

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 345 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
345	0		Organic Laden Material (OLM), 5"										
			SILTY SAND (SM), dark brown, loose - FILL	SS		3-4-3 (7)			14				
			CLAYEY SAND (SC), dark brown, medium	SS		4-5-6 (11)	4.0		12	21	11	10	39
340	5		SANDY LEAN CLAY (CL), pink, gray, soft	SS		1-2-2 (4)	4.5		25				
			SANDY LEAN CLAY (CL), pink, gray, stiff	SS		6-6-9 (15)	4.5						
335	10			SS		4-5-9 (14)	4.5						
			Boring was terminated at 10.5 feet.										
330	15												
325	20												
320	25												

1.GMC BORINGS GMGM250037 DHR HOUSTON COUNTY.GPJ GMC DATA TEMPLATE.GDT 9/8/25

BORING NUMBER P-05

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 345 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
345	0		Organic Laden Material (OLM), 4"										
			SILTY SAND (SM), dark brown, loose - FILL	SS		3-4-4 (8)			14				
			CLAYEY SAND (SC), brown, loose	SS		2-2-3 (5)	3.0		16				
340	5		SANDY LEAN CLAY (CL), pink, gray, light brown, stiff to very stiff	SS		2-4-6 (10)	4.5		16				
				SS		6-6-7 (13)	2.5						
335	10			SS		4-7-9 (16)	4.5						
			Boring was terminated at 10.5 feet.										
330	15												
325	20												
320	25												

BORING NUMBER P-06

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 338 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 7"										
			SILTY SAND (SM), dark brown, very loose, w/ organics - FILL	SS		1-1-1 (2)			14				
335				SS		0-0-0 (0)			11				
			SANDY LEAN CLAY (CL), reddish brown, white, medium to stiff										
	5			SS		2-3-3 (6)	4.5		26				
330				SS		6-6-7 (13)	2.5						
	10		SANDY LEAN CLAY (CL), reddish brown, white, very stiff	SS		7-8-10 (18)	2.5						
			Boring was terminated at 10.5 feet.										
325													
	15												
320													
	20												
315													
	25												

BORING NUMBER P-07

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 340 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
340	0		Organic Laden Material (OLM), 6"										
			CLAYEY SAND (SC), brown, dark brown, loose, w/ organics	SS		3-4-4 (8)	2.0		13				
			CLAYEY SAND (SC), yellowish brown, loose	SS		2-3-5 (8)	2.5		18				
335	5		CLAYEY SAND (SC), yellowish brown, medium	SS		4-7-8 (15)	3.0		19				
				SS		6-8-12 (20)	2.5						
330	10		CLAYEY SAND (SC), pink, reddish brown, medium	SS		0-12-13 (25)	2.5						
			Boring was terminated at 10.5 feet.										
325	15												
320	20												
315	25												

BORING NUMBER P-08

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 340 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
340	0		Organic Laden Material (OLM), 5"										
			SILTY SAND (SM), dark brown, medium - FILL	SS		4-5-6 (11)			16				
			CLAYEY SAND (SC), brown, loose, w/ organics	SS		4-4-5 (9)			12				
335	5		CLAYEY SAND (SC), dark reddish brown, loose	SS		6-3-4 (7)	3.0		17				
			CLAYEY SAND (SC), pale brown, medium	SS		5-9-10 (19)	3.0						
330	10			SS		8-10-12 (22)							
			Boring was terminated at 10.5 feet.										
325	15												
320	20												
315	25												

BORING NUMBER P-09

GMC

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 334 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 9"										
			SILTY SAND (SM), dark brown, loose, w/ organics - FILL	SS		2-3-5 (8)			12	NP	NP	NP	22
				SS		3-5-5 (10)			9				
330			CLAYEY SAND (SC), brown, loose										
	5			SS		3-4-5 (9)	2.0		13				
			SANDY LEAN CLAY (CL), brown, gray, stiff	SS		5-7-8 (15)	2.5						
325													
	10		SANDY LEAN CLAY (CL), brown, gray, medium	SS		3-3-3 (6)	4.0						
			Boring was terminated at 10.5 feet.										
320													
	15												
315													
	20												
310													
	25												

1.GMC BORINGS GMGM250037 DHR HOUSTON COUNTY.GPJ GMC DATA TEMPLATE.GDT 9/8/25

BORING NUMBER P-10

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 336 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 6"										
335			SILTY SAND (SM), dark brown, very loose, w/ organics - FILL	SS		1-1-1 (2)			11				
			SILTY SAND (SM), light brown, very loose- FILL	SS		1-1-2 (3)			10				
			CLAYEY SAND (SC), brown, loose to medium										
	5			SS		3-4-5 (9)	2.5		11				
330													
				SS		5-7-9 (16)	3.0						
			- reddish brown	SS		8-9-11 (20)	2.5						
	10												
325			Boring was terminated at 10.5 feet.										
	15												
320													
	20												
315													
	25												

BORING NUMBER P-11

CLIENT Houston County Commission
PROJECT NAME DHR Houston County
PROJECT NUMBER GMGM250037
PROJECT LOCATION Dothan, AL
DATE STARTED 8/13/25 **COMPLETED** 8/13/25
GROUND ELEVATION 332 ft **HOLE SIZE** 4"
DRILLING CONTRACTOR Earth Core, LLC
GROUND WATER LEVELS:
DRILLING METHOD Geoprobe 7822DT, Auto-Hammer, HSA w/ SPT
AT TIME OF DRILLING None Encountered
LOGGED BY J. Thomas **CHECKED BY** D. Gamlin
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		Organic Laden Material (OLM), 4"										
			SILTY SAND (SM), dark brown, very loose - FILL	SS		0-1-1 (2)			12				
330				SS		1-1-1 (2)	1.0		9				
			CLAYEY SAND (SC), brown, very loose										
	5			SS		0-0-0 (0)	1.0		15				
325			CLAYEY SAND (SC), brown, white, medium	SS		4-5-6 (11)	1.5						
	10			SS		8-9-10 (19)	3.0						
			Boring was terminated at 10.5 feet.										
320													
	15												
315													
	20												
310													
	25												

1.GMC BORINGS GMGM250037 DHR HOUSTON COUNTY.GPJ GMC DATA TEMPLATE.GDT 9/8/25

SUMMARY OF LABORATORY RESULTS

CLIENT Houston County Commission **PROJECT NAME** DHR Houston County

PROJECT NUMBER GMGM250037 **PROJECT LOCATION** Dothan, AL

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Max. Sieve Size Tested (mm)	%<#200 Sieve	Natural Moisture (%)	Class-ification	Opt. Moisture Content (%)	Max Dry Density (pcf)	Specific Gravity
B-01	0-1.5						15.3				
B-01	1.5-3						14.8				
B-01	4-5.5						19.8				
B-01	6.5-8						20.3				
B-02	0-1.5						13.8				
B-02	1.5-3						9.7				
B-02	4-5.5	27	15	12	9.5	36	16.0	SC			
B-02	6.5-8						20.8				
B-03	0-1.5						13.0				
B-03	1.5-3						7.2				
B-03	4-5.5						12.9				
B-03	6.5-8						14.9				
B-04	0-1.5						15.4				
B-04	1.5-3	23	11	12	4.75	35	12.0	SC			
B-04	4-5.5						14.6				
B-04	6.5-8						11.7				
B-05	0-1.5						11.4				
B-05	1.5-3						14.4				
B-05	4-5.5						13.6				
B-05	6.5-8						11.6				
B-06	0-1.5	NP	NP	NP	9.5	20	12.6	SM			
B-06	1.5-3						11.6				
B-06	4-5.5						16.3				
B-06	6.5-8						18.4				
P-01	0-1.5						9.8				
P-01	1.5-3						9.2				
P-01	4-5.5						15.6				
P-02	0-1.5						11.4				
P-02	1.5-3						5.5				
P-02	4-5.5						13.6				
P-03	0-1.5						14.2				
P-03	1.5-3						14.1				
P-03	4-5.5						15.0				
P-04	0-1.5						13.8				
P-04	1.5-3	21	11	10	9.5	39	12.0	SC			
P-04	4-5.5						24.8				
P-05	0-1.5						13.7				
P-05	1.5-3						15.7				
P-05	4-5.5						16.4				
P-06	0-1.5						13.9				
P-06	1.5-3						10.9				
P-06	4-5.5						25.7				
P-07	0-1.5						12.5				

SUMMARY OF LABORATORY RESULTS

CLIENT Houston County Commission **PROJECT NAME** DHR Houston County

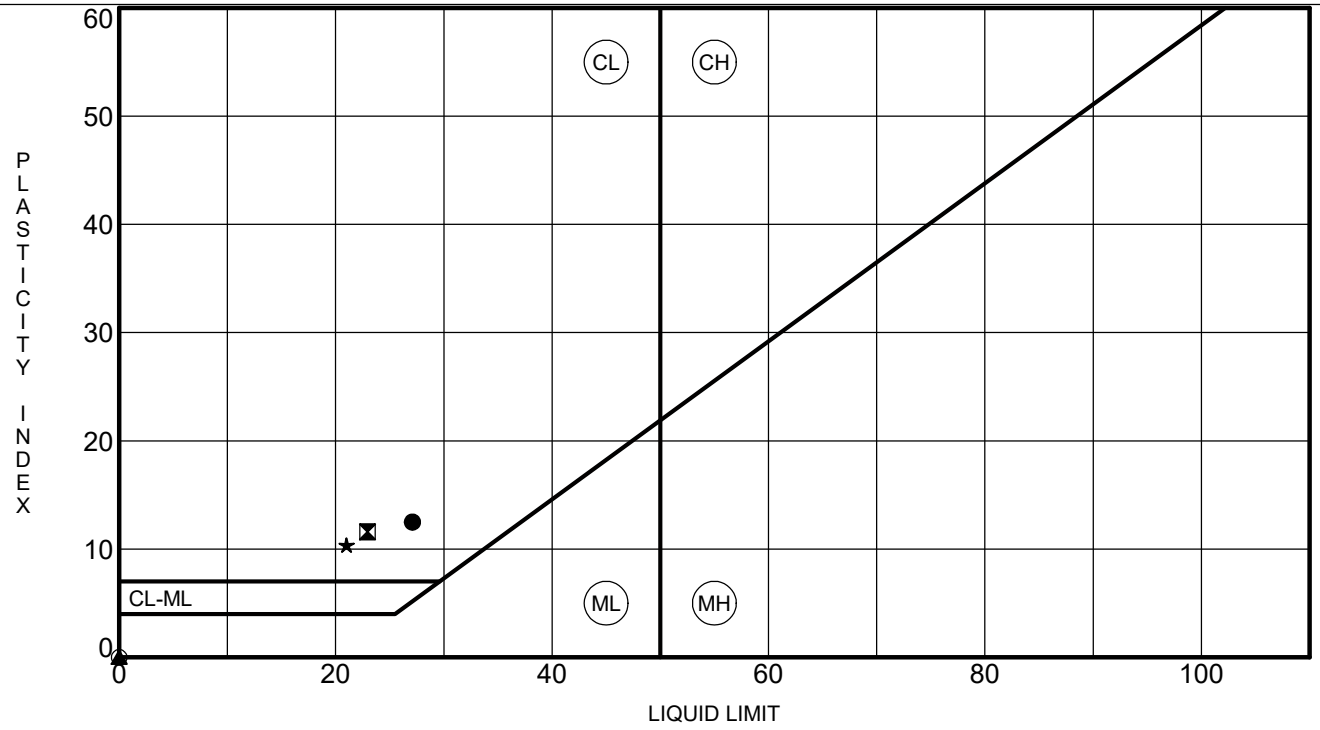
PROJECT NUMBER GMGM250037 **PROJECT LOCATION** Dothan, AL

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Max. Sieve Size Tested (mm)	%<#200 Sieve	Natural Moisture (%)	Class-ification	Opt. Moisture Content (%)	Max Dry Density (pcf)	Specific Gravity
P-07	1.5-3						17.9				
P-07	4-5.5						19.1				
P-08	0-1.5						15.7				
P-08	1.5-3						12.1				
P-08	4-5.5						16.9				
P-09	0-1.5	NP	NP	NP	9.5	22	12.1	SM			
P-09	1.5-3						8.9				
P-09	4-5.5						12.9				
P-10	0-1.5						11.1				
P-10	1.5-3						9.7				
P-10	4-5.5						11.5				
P-11	0-1.5						11.9				
P-11	1.5-3						8.5				
P-11	4-5.5						15.2				

ATTERBERG LIMITS' RESULTS

CLIENT Houston County Commission **PROJECT NAME** DHR Houston County

PROJECT NUMBER GMGM250037 **PROJECT LOCATION** Dothan, AL

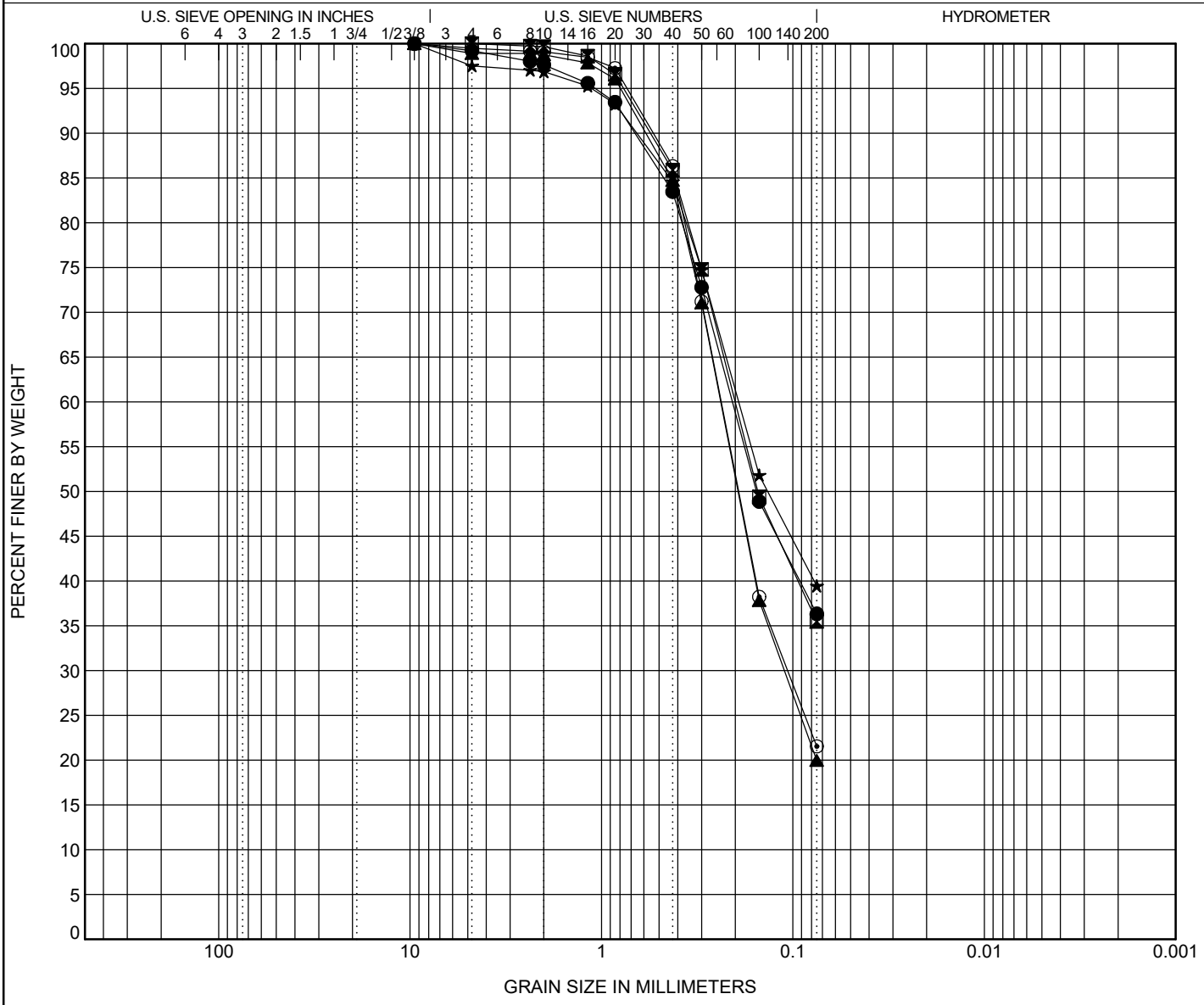


	Specimen Identification		LL	PL	PI	Fines	Classification
●	**B-02**	**4.0-5.5**	**27**	**15**	**12**	**36**	**CLAYEY SAND(SC)**
⊠	**B-04**	**1.5-3.0**	**23**	**11**	**12**	**35**	**CLAYEY SAND(SC)**
▲	**B-06**	**0.0-1.5**	**NP**	**NP**	**NP**	**20**	**SILTY SAND(SM)**
★	**P-04**	**1.5-3.0**	**21**	**11**	**10**	**39**	**CLAYEY SAND(SC)**
⊙	**P-09**	**0.0-1.5**	**NP**	**NP**	**NP**	**22**	**SILTY SAND(SM)**

GRAIN SIZE DISTRIBUTION

CLIENT Houston County Commission **PROJECT NAME** DHR Houston County

PROJECT NUMBER GMGM250037 **PROJECT LOCATION** Dothan, AL



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-02	4.0-5.5	CLAYEY SAND(SC)	27	15	12		
⊠	B-04	1.5-3.0	CLAYEY SAND(SC)	23	11	12		
▲	B-06	0.0-1.5	SILTY SAND(SM)	NP	NP	NP		
★	P-04	1.5-3.0	CLAYEY SAND(SC)	21	11	10		
⊙	P-09	0.0-1.5	SILTY SAND(SM)	NP	NP	NP		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-02	4.0-5.5	9.5	0.207			0.8	62.9	36.3	
⊠	B-04	1.5-3.0	4.75	0.2			0.0	64.5	35.5	
▲	B-06	0.0-1.5	9.5	0.238	0.111		1.1	78.9	20.0	
★	P-04	1.5-3.0	9.5	0.192			2.5	58.1	39.5	
⊙	P-09	0.0-1.5	9.5	0.237	0.107		0.5	77.9	21.5	

GMC

FIELD TEST PROCEDURES

General

The general field procedures employed by Goodwyn Mills Cawood, LLC (GMC), are summarized in the American Society for Testing and Materials (ASTM) Standard D420 which is entitled "Investigating and Sampling Soil and Rock". This recommended practice lists recognized methods for determining soil and rock distribution and groundwater conditions. These methods include geophysical and in-situ methods as well as borings.

The detailed collection methods used during this exploration are presented in the following paragraphs.

Standard Drilling Techniques

General: To obtain subsurface samples, borings are drilled using one of several alternate techniques depending upon the subsurface conditions. These techniques are as follows:

In Soils:

a) Continuous hollow stem augers.
b) Rotary borings using roller cone bits or drag bits, and water or drilling mud to flush the hole.
c) "Hand" augers.

In Rock:

a) Core drilling with diamond-faced, double or triple tube core barrels.
b) Core boring with roller cone bits.

Hollow Stem Auger: A hollow stem augers consists of a hollow steel tube with a continuous exterior spiral flange termed a flight. The auger is turned into the ground, returning the cuttings along the flights. The hollow center permits a variety of sampling and testing tools to be used without removing the auger.

Rotary Borings: Rotary drilling involves the use of roller cone or drag type drill bits attached to the end of drill rods. A flushing medium, normally water or bentonite slurry, is pumped through the rods to clear the cuttings from the bit face and flush them to the surface. Casing is sometimes set behind the advancing bit to prevent the hole from collapsing and to restrict the penetration of the drilling fluid into the surrounding soils. Cuttings returned to the surface by the drilling fluid are typically collected in a settling tank, to allow the fluid to be recirculated.

Hand Auger Boring: Hand auger borings are advanced by manually twisting a 4" diameter steel bucket auger into the ground and withdrawing it when filled to observe the sample collected. Posthole diggers are sometimes used in lieu of augers to obtain shallow soil samples. Occasionally these hand auger borings are used for driving 3-inch diameter steel tubes to obtain intact soil samples.

Dual-Mass Dynamic Cone Penetrometer: Dual-Mass Dynamic Cone Penetrometer tests (DM-DCP) test is intended to provide data that can be correlated to an in situ California Bearing Ratio test. A 0.79-inch O.D. cone is seated at the test location and driven with a 17.6-pound (or 10.1-pound) weight falling 22.6 inches. The length of penetration is recorded with a given number of blows. The values are then evaluated and correlated with an in situ CBR.

Dynamic Cone Penetrometer: Dynamic Cone Penetrometer tests (DCP) is intended to provide data that can be correlated to the standard penetration test (SPT). A 1.5 inch O.D. cone is seated to penetrate any loose cuttings, then driven three, 1-3/4" increments with blows from a 15-pound weight falling 20 inches. The average number of blows required to drive the cone three increments is an index to soil strength and compressibility.

Core Drilling: Soil drilling methods are not normally capable of penetrating through hard cemeted soil, weathered rock, coarse gravel or boulders, thin rock seams, or the upper surface of sound, continuous rock. Material that cannot be penetrated by auger or rotary soil-drilling methods at a reasonable rate is designated as “refusal material”. Core drilling procedures are required to penetrate and sample refusal materials.

Prior to coring, casing may be set in the drilled hole through the overburden soils, to keep the hole from caving and to prevent excessive water loss. The refusal materials are then cored according to ASTM D2113 using a diamond studded bit fastened to the end of a hollow, double or triple tube core barrel. This device is rotated at high speeds, and the cuttings are brought to the surface by circulating water. Core samples of the material penetrated are protected and retained in the swivel-mounted inner tube. Upon completion of each drill run, the core barrel is brought to the surface, the core recovery is measured, and the core is placed, in sequence, in boxes for storage and transported to our laboratory.

Sampling and Testing in Boreholes

General: Several techniques are used to obtain samples and data in soils; however, the most common methods in this area are:

a) Standard Penetrating Testing
b) Water Level Readings

These procedures are presented below. Any additional testing techniques employed during this exploration are contained in other sections of the Appendix.

Standard Penetration Testing: At regular intervals, the drilling tools are removed and soil samples obtained with a standard 2-inch diameter split tube sampler connected to an A or N-size rod. The sampler is first seated 6 inches to penetrate any loose cuttings, and then driven an additional 12 inches with blows of a 140-pound safety hammer falling 30 inches. Generally, the number of hammer blows required to drive the sampler the final 12 inches is designated the "penetration resistance" or "N" value, in blows per foot (bpf). The split barrel sampler is designed to retain the soil penetrated, so that it may be returned to the surface for observation. Representative portions of the soil samples obtained from each split barrel sample are placed in jars, sealed and transported to our laboratory.

The standard penetration test, when properly evaluated, provides an indication of the soil strength and compressibility. The tests are conducted according to ASTM Standard D1586. The depths and N-values of standard penetration tests are shown on the Boring Records. Split barrel samples are suitable for visual observation and classification tests but are not sufficiently intact for quantitative laboratory testing.

Water Level Readings: Water table readings are normally taken in the borings and are recorded on the Boring Records. In sandy soils, these readings indicate the approximate location of the hydrostatic water table at the time of our field exploration. In clayey soils, the rate of water seepage into the borings is low and it is generally not possible to establish the location of the hydrostatic water table through short-term water level readings. Also, fluctuation in the water table should be expected with variations in precipitation, surface run-off, evaporation, and other factors. For long-term monitoring of water levels, it is necessary to install piezometers. The water levels reported on the Boring Records are determined by field crews immediately after the drilling tools are removed, and several hours after the borings are completed, if possible. The time lag is intended to permit stabilization of the groundwater table, which may have been disrupted by the drilling operation.

Occasionally the borings will cave-in, preventing water level readings from being obtained or trapping drilling water above the cave-in zone. The cave-in depth is measured and recorded on the Boring Records.

Boring Records

The subsurface conditions encountered during drilling are reported on a field boring record prepared by the Driller. The record contains information concerning the boring method, samples attempted and recovered, indications of the presence of coarse gravel, cobbles, etc., and observations of ground water. It also contains the driller's interpretation of the soil conditions between samples. Therefore, these boring records contain both factual and interpretive information. The field boring records are kept on file in our office.

After the drilling is completed, a geotechnical professional classifies the soil samples and prepares the final Boring Records, which are the basis for all evaluations and recommendations. The following terms are taken from ASTM D2487 or Deere's Technical Description of Rock Cores for Engineering Purposes, Rock Mechanical Engineering Geology 1, pp. 18-22.

Relative Density of Cohesionless Soils From Standard Penetration Test	
Very Loose	‹ 4 bpf
Loose	5 - 10 bpf
Medium	11 – 30 bpf
Dense	31 - 50 bpf
Very Dense	› 50 bpf
(bpf = blows per foot, ASTM D 1586)	

Consistency of Cohesive Soils	
Very Soft	‹ 2 bpf
Soft	3 - 4 bpf
Medium	5 - 8 bpf
Stiff	9 - 15 bpf
Very Stiff	16 - 30 bpf
Hard	› 30 bpf

Relative Hardness of Rock
Very Soft Rock disintegrates or easily compresses to touch; can be hard to very hard soil.
Soft Rock may be broken with fingers.
Moderately Soft Rock may be scratched with a nail, corners and edges may be broken with fingers.
Moderately Hard Rock a light blow of hammer is required to break samples.
Hard Rock a hard blow of hammer is required to break sample.

Particle Size Identification	
Boulders	Larger than 12"
Cobbles	3" - 12"
Gravel	
Coarse	3/4" - 3"
Fine	4.76mm - 3/4"
Sand	
Coarse	2.0 - 4.76 mm
Medium	0.42 - 2.00 mm
Fine	0.42 - 0.074 mm
Fines (Silt or Clay)	Smaller than 0.074 mm

Rock Continuity

RECOVERY = $\frac{\text{Total Length of Core}}{\text{Length of Core Run}}$ x 100 %

Description	Core Recovery %
Incompetent	Less than 40
Competent	40 - 70
Fairly Continuous	71 - 90
Continuous	91 - 100

Relative Quality of Rocks

RQD = $\frac{\text{Total core, counting only pieces › 4" long}}{\text{Length of Core Run}}$ x 100 %

Description	RQD %
Very Poor	0 - 25 %
Poor	25 - 50 %
Fair	50 - 75 %
Good	75 - 90 %
Excellent	90 - 100 %

GMC

LABORATORY TESTING

GENERAL

The laboratory testing procedures employed by Goodwyn Mills Cawood, LLC (GMC) are in general accordance with ASTM standard methods and other applicable specifications. Several test methods, described together with others in this Appendix, were used during the course of this exploration. The Laboratory Data Summary sheet indicates the specific tests performed.

SOIL CLASSIFICATION

Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply past experience to current problems. In our investigations, samples obtained during drilling operations are examined in our laboratory and visually classified by an engineer. The soils are classified according to consistency (based on number of blows from standard penetration tests), color and texture. These classification descriptions are included on our "Boring Records".

The classification system discussed above is primarily qualitative and for detailed soil classification, two laboratory tests are commonly performed: grain size tests and plasticity tests. Using these test results the soil can be classified according to the AASHTO or Unified Classification Systems (ASTM D2487). Each of these classification systems and the in-place physical soil properties provides an index for estimating the soil's behavior. The soil classification and physical properties obtained are presented in this report.

POCKET PENETROMETER TEST

A pocket penetrometer test is performed by pressing the tip of a small, spring-loaded penetrometer with even pressure to a prescribed depth into a soil sample. This test yields a value for unconfined compressive strength, which may be correlated with unconfined compressive strengths obtained by other laboratory methods.

MOISTURE CONTENT

Moisture contents are determined from representative portions of the specimen. The soil is dried to a constant weight in an oven at 100° C and the loss of moisture during the drying process is measured. From this data, the moisture content is computed.

ATTERBERG LIMITS

Liquid Limit (LL), Plastic Limit (PL) and Shrinkage Limit (SL) tests are performed to aid in the classification of soils and to determine the plasticity and volume change characteristics of the materials. The Liquid Limit is the minimum moisture content at which a soil will flow as a heavy viscous fluid. The Plastic Limit is the minimum moisture content at which the soil behaves as a plastic material. The Shrinkage Limit is the moisture content below which no further volume change will take place with continued drying. The Plasticity Index (PI) is the numeric difference of Liquid Limit and Plastic Limit and indicates the range of moisture content over which a soil remains plastic. These tests are performed in accordance with ASTM D4318, D4943 and D427.

PARTICLE SIZE DISTRIBUTION

The distribution of soils coarser than the No. 200 (75-mm) sieve is determined by passing a representative specimen through a standard set of nested sieves. The weight of material retained on each sieve is determined and the percentage retained (or passing) is calculated.

A specimen may be washed through only the No. 200 sieve, if the full range of particle sizes is not required. The percentage of material passing the No. 200 sieve is reported.

The distribution of materials finer than the No. 200 sieve is determined by use of a hydrometer. The particle sizes and distribution are computed from the time rate of settlement of the different size particles while suspended in water. These tests are performed in accordance with ASTM D421, D422 and D1140.