



3151 Hyde Park Road
Pensacola, Florida

MIDDLE SCHOOL ADDITION

100% CONSTRUCTION DOCUMENTS SPECIFICATIONS

CAA Project No. 22028
17 November, 2023

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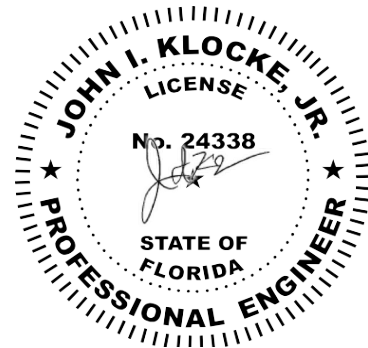
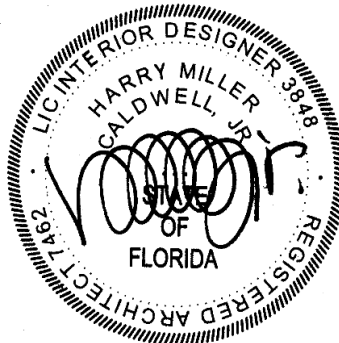
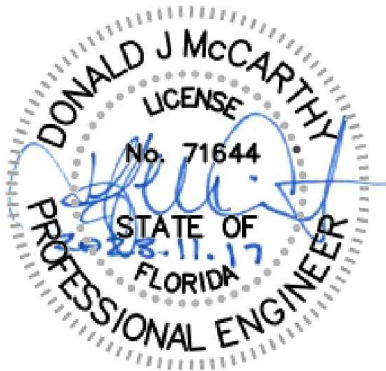
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SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under Owner's separate contracts.
4. Contractor's use of site and premises.
5. Specification and Drawing conventions.

B. Related Requirements:

1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: 22028 – Creative Learning Academy – Middle School Addition

1. Project Location: 3151 Hyde Park Road, Pensacola, FL, 32503

B. Owner: Creative Learning Academy, 3151 Hyde Park Road, Pensacola, FL, 32503.

1. Owner's Representative: Kim Stafford, (850) 432-1768
kstafford@creativelearningacademy.org.

C. Architect: Caldwell Associates Architects, Inc.; 116 N Tarragona Street, Pensacola, FL 32502

1. Architect's Representative: Michael Crawford; (850) 439-6578; michael@caldwell-assoc.com.

D. Contractor: Green-Simmons Company, Inc. has been engaged as Contractor for this Project.

1. Contractor Representative: Nathan Green; (850) 429-0144,
nathan@green-simmons.com.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following: New construction of an approx. 14,300 SF classroom building. Steel and concrete structural frame system, metal stud walls, concrete slab, and single ply roof construction.

B. Type of Contract: Project will be constructed under a single prime contract.

1.4 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

1.5 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Restricted Use of Site: Access to the project site will require circulation through existing property in use. Contractor shall have limited use of Project site for construction operations as indicated by requirements of this Section.
- B. Limits on Use of Site: Limit use of Project site to areas within the project site access and construction limits. Do not disturb portions of the project site beyond areas in which the Work is indicated existing buildings and open areas shall remain in use by the Owner during construction.
- C. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period, except where indicated to be replaced by the new work. Repair damage caused by construction operations.

1.6 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
- B. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Project site is not permitted at any time.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 - 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.

4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

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SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. 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.
 - 2. 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.

1.3 ACTION SUBMITTALS

- A. Substitution Requests: Submit one electronic (.PDF) copy of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use form acceptable to Architect.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
 - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.5 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.6 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.
 - e. Requested substitution will not adversely affect Contractor's construction schedule.

- f. Requested substitution has received necessary approvals of authorities having jurisdiction.
- g. Requested substitution is compatible with other portions of the Work.
- h. Requested substitution has been coordinated with other portions of the Work.
- i. Requested substitution provides specified warranty.
- j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within 14 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 01 25 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.4 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in 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 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. Arrange schedule of values consistent with format of AIA Document G703.
 - 2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - 3. 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.
 - 4. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
 - 5. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
 - 6. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

- 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.
1. Submit draft copy "Payment Application #0" of Application for Payment seven days prior to due date for review and record by Architect.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 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. Architect 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 for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Submit one signed and notarized copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. Said copy shall include waivers of lien and similar attachments if required.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional 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 conditional 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 executed waivers of lien on forms 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.
 3. Contractor's construction schedule.
 4. Products list.
 5. Copies of building permits.

6. Initial progress report.
 7. Certificates of insurance and insurance policies.
 8. Performance and payment bonds.
 9. Data needed to acquire Owner's insurance.
- H. Application for Payment at Substantial Completion: After Architect issues 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.
- I. Final Payment Application: After completing Project closeout requirements, 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. AIA Document G706.
 5. AIA Document G706A.
 6. Evidence that claims have been settled, if any.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

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SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. RFIs.
 - 4. Project meetings.
- B. Related Requirements:
 - 1. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 - 1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
 - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 - 1. Architect's Project number.
 - 2. Date.
 - 3. RFI number, numbered sequentially.
 - 4. RFI subject.
 - 5. Specification Section number and title and related paragraphs, as appropriate.
 - 6. Drawing number and detail references, as appropriate.
 - 7. Field dimensions and conditions, as appropriate.
 - 8. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 - 9. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
- C. RFI Forms: AIA Document G716 or as provided by Architect's Project Management Website.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow five days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within three days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log bi-weekly or utilize Architect's Project Management Website.

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within three days if Contractor disagrees with response.

1.3 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of select Architect's CAD drawings will be provided by Architect for Contractor's use during construction.

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.

2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
 3. Digital Drawing Software Program: Contract Drawings are available in AutoCAD .DWG format; exact versioning can be tailored to Contractor's needs within the limits of Architect's software.
 4. Contractor shall execute a data licensing agreement in the form of Architects standard Agreement form.
 - a. Subcontractors, and other parties granted access by Contractor to Architect's digital data files shall obtain files through the Contractor.
 5. The following digital data files will be furnished for each appropriate discipline:
 - a. Floor plans.
 - b. Reflected ceiling plans.
 - c. Exterior elevations.
- B. Web-Based Project Management Website: Use Architect's web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion.
1. Web-based Project management software includes, at a minimum, the following features:
 - a. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
 - b. Document workflow planning, allowing customization of workflow between project entities.
 - c. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
 - d. Track status of each Project communication in real time, and log time and date when responses are provided.
 - e. Processing and tracking of payment applications.
 - f. Processing and tracking of contract modifications.
 - g. Document management for Drawings, Specifications, and coordination drawings, including revision control.
 - h. Mobile device compatibility, including smartphones and tablets.
- C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section.
 2. Name file with submittal number or other unique identifier, including revision identifier.

1.4 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than ten days after execution of the Agreement.
 - 1. Attendees: Authorized representatives of Owner, Architect, Contractor and its superintendent; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Responsibilities and personnel assignments.
 - b. Tentative construction schedule.
 - c. Critical work sequencing and long lead items.
 - d. Designation of key personnel and their duties.
 - e. Lines of communications.
 - f. Use of web-based Project software.
 - g. Procedures for processing field decisions and Change Orders.
 - h. Procedures for RFIs.
 - i. Procedures for testing and inspecting.
 - j. Procedures for processing Applications for Payment.
 - k. Distribution of the Contract Documents.
 - l. Submittal procedures.
 - m. Use of the premises.
 - n. Responsibility for temporary facilities and controls.
 - o. Procedures for moisture and mold control.
 - p. Procedures for disruptions and shutdowns.
 - q. Construction waste management and recycling.
 - r. Parking availability.
 - s. Office, work, and storage areas.
 - t. Equipment deliveries and priorities.
 - u. First aid.
 - v. Security.
 - w. Progress cleaning.
 - 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.
 - 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and

installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Conduct progress meetings at biweekly intervals.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site use.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of Proposal Requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.
3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Submittal schedule requirements.
 - 2. Administrative and procedural requirements for submittals.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect'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."

1.3 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
 - 1. Project name.
 - 2. Date.
 - 3. Name of Architect.
 - 4. Name of Contractor.
 - 5. Name of firm or entity that prepared submittal.
 - 6. Names of subcontractor, manufacturer, and supplier.
 - 7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
 - 8. Category and type of submittal.
 - 9. Submittal purpose and description.

10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
11. Drawing number and detail references, as appropriate.
12. Indication of full or partial submittal.
13. Location(s) where product is to be installed, as appropriate.
14. Other necessary identification.
15. Remarks.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Paper Submittals:

1. Sample Submittals: Submit samples as required by other sections with product data information sufficient to identify separate samples and their qualities. Separate Informational submittals will be submitted Electronically or through Architect's Project Management Website. Place a permanent label or title block on each submittal item for identification; include name of firm or entity that prepared submittal.
2. Paper submittals will be accepted for Sample submittals only. All other submittal types will not be reviewed and returned to Contractor.

E. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

F. Submittals for Utilizing Web-Based Project Management Software: Prepare submittals as PDF files, or other format indicated by Project management software.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package, and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.
3. Paper: Prepare submittals in paper form, and deliver to Architect.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Resubmittal Review: Allow 14 days for review of each resubmittal.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.6 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.

- b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 - 5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 - 2. Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
 - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 - 3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
 - 4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
 - 5. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

- a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
6. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available. Actual samples must be submitted, not printed or otherwise reproduced images of samples.
- a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
7. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
- a. Number of Samples: Submit one sets of Samples. Architect will return Sample sets. Mark up and retain one Sample set as a project record Sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.

- d. Product and manufacturers' names.
- e. Description of product.
- f. Test procedures and results.
- g. Limitations of use.

1.7 DELEGATED DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
 - 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it.
 - 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.
 - a. "Furnish as Submitted": Architect has reviewed the submittal and approves the product for meeting the design intent of the Construction Documents. Additional

notations that are not necessarily corrections may be included for clarity and coordination with other work.

- b. "Furnish as Corrected": Architect has reviewed the submittal and with the incorporation of comments and corrections as indicated on the submittal, approves the submittal as meeting the design intent and for use in the project. Additional notations that are not necessarily corrections may be included for clarity and coordination with other work.
 - c. "Revise and Resubmit": Architect has reviewed the submittal and due to the critical nature of certain comments, requests the submittal be corrected and re-submitted for Architect's review. This comment may also be used to indicate missing submittal requirements that need to be reviewed before proceeding with the work outlined by the submittal.
 - d. Architect may use one or more of the above comments in combination to communicate the full scope and intent of his review and requests for additional information (if any).
- 2. Paper Submittals: Architect will scan or photograph samples and return a .PDF for each submittal with an action stamp and will mark stamp appropriately to indicate action.
 - 3. Submittals by Web-Based Project Management Software: Architect will indicate, on Project management software website, the appropriate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
 - C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
 - D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
 - E. Architect will return without review submittals received from sources other than Contractor.
 - F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 2. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
 - 1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
- D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.
 - 1. Mockups are used for one or more of the following:
 - a. Verify selections made under Sample submittals.
 - b. Demonstrate aesthetic effects.
 - c. Demonstrate the qualities of products and workmanship.
 - d. Demonstrate successful installation of interfaces between components and systems.

- e. Perform preconstruction testing to determine system performance.
 - 2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
 - 3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.
- E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
 - F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
 - G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.
 - H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."
 - I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
 - J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.3 DELEGATED DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated Design Services Statement: Submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.4 CONFLICTING REQUIREMENTS

- A. **Conflicting Standards and Other Requirements:** If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.
- B. **Minimum Quantity or Quality Levels:** The quantity or quality level shown or specified is 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 Architect for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

- A. **Contractor's Statement of Responsibility:** When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
 - 1. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- B. **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.
- C. **Permits, Licenses, and Certificates:** For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.6 REPORTS AND DOCUMENTS

- A. **Test and Inspection Reports:** Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, telephone number, and email address of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.

10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Statement on condition of substrates and their acceptability for installation of product.
 2. Statement that products at Project site comply with requirements.
 3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 5. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Statement that equipment complies with requirements.
 2. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 3. Other required items indicated in individual Specification Sections.

1.7 QUALITY ASSURANCE

- A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.
 - 1. Requirements of authorities having jurisdiction supersede requirements for specialists.
- G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- K. 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. Notify Architect seven days in advance of dates and times when mockups will be constructed.
2. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed to perform same tasks during the construction at Project.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting corresponding work, fabrication, or construction.
 - a. Allow five days for initial review and each re-review of each mockup.
5. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
6. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
8. Demolish and remove mockups when directed unless otherwise indicated.

1.8 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
 2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
 1. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 6. Do not perform duties of Contractor.
- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."
- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 6. Security and protection for samples and for testing and inspection equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and authorities' having jurisdiction reference during normal working hours.
 1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Reviewed": When used to convey Architect's action on Contractor's submittals, applications, and requests, "reviewed" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "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."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
 - 1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
 1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 2. ICC - International Code Council; www.iccsafe.org.
 3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
 1. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
 2. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
 3. DOE - Department of Energy; www.energy.gov.
 4. EPA - Environmental Protection Agency; www.epa.gov.
 5. GSA - General Services Administration; www.gsa.gov.
 6. OSHA - Occupational Safety & Health Administration; www.osha.gov.
 7. SD - Department of State; www.state.gov.
 8. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
 1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.govinfo.gov.
 2. FED-STD - Federal Standard; (See FS).
 3. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
 - a. Available from General Services Administration; www.gsa.gov.
 - b. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.

4. USAB - United States Access Board; www.access-board.gov.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

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SECTION 01 43 39 - MOCKUPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Integrated exterior mockups.

1.2 DEFINITIONS

- A. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as freestanding temporary built elements or a part of permanent construction, consisting of multiple products, assemblies, and subassemblies.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, testing and inspecting agency representative, and installers of major systems whose Work is included in integrated exterior mockups.
 - 2. Review locations and extent of mockups.
 - 3. Review testing procedures to be performed on mockups.
 - 4. Review and finalize schedule for mockups, and verify availability of materials, personnel, equipment, and facilities needed to complete mockups and maintain schedule for the Work.

1.4 ACTION SUBMITTALS

- A. Delegated Design Submittal: For temporary structural supports for mockups not attached to building structure, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Preconstruction Test Reports: For integrated exterior mockups.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and acceptable to Owner and Architect.
- B. Build mockups to do the following:
 - 1. Verify selections made under Sample submittals.

2. Demonstrate aesthetic effects.
 3. Demonstrate the qualities of products and workmanship.
 4. Demonstrate acceptable coordination between components and systems.
 5. Perform preconstruction testing, such as window air- and water-leakage testing.
- C. Fabrication: Before fabricating or installing portions of the Work requiring mockups, build mockups for each form of construction and finish required. Use materials and installation methods as required for the Work.
1. Build mockups of size indicated.
 2. Build mockups in location indicated or, if not indicated, as coordinated with Architect.
 3. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 6. Demolish and remove mockups which are freestanding temporary built element when directed unless otherwise indicated.
- D. Notifications:
1. Notify Architect seven days in advance of the dates and times when mockups will be constructed.
 2. Notify Architect 14 days in advance of the dates and times when mockups will be tested.
 3. Allow seven days for initial review and each re-review of each mockup.
- E. Approval: Obtain Architect's approval of mockups before starting fabrication or construction of corresponding Work.
1. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 COORDINATION

- A. Coordinate schedule for construction of mockups, so construction, testing, and review of mockups do not impact Project schedule.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design support structure for free-standing mockups.

- B. Structural Performance:
 - 1. Wind Loads: As indicated on Drawings.
- C. Mockup Testing Performance Requirements: Perform tests using design pressures and performance criteria indicated for assemblies and products that are specified in other Sections and incorporated into integrated exterior mockups.

2.2 INTEGRATED EXTERIOR MOCKUPS

- A. Construct mockups to demonstrate constructability, coordination of trades, and sequencing of Work; and to ensure materials, components, subassemblies, assemblies, and interfaces integrate into a system complying with indicated performance and aesthetic requirements.
- B. Design and construct foundation and superstructure to support free-standing integrated exterior mockups.
- C. Build integrated exterior mockups using installers and construction methods that will be used in completed construction.
- D. Use specified products that have been approved by Architect. Coordinate installation of materials and products specified in individual Specification Sections that include Work included in integrated exterior mockups.
- E. The Work of integrated exterior mockups includes, but is not limited to, the following:
 - 1. Masonry veneer.
 - 2. Exterior Insulation Finish System.
 - 3. Cold-formed metal framing and sheathing.
 - 4. Air and weather barriers.
 - 5. Thermal insulation.
 - 6. Through-wall flashing.
 - 7. Flashing and sheet metal trim.
 - 8. Joint sealants.
 - 9. Aluminum-framed entrances and storefront.
 - 10. Glazing.
- F. Provide and document modifications to construction details and interfaces between components and systems required to properly sequence the Work, or to pass performance testing requirements. Obtain Architect's approval for modifications.
- G. Retain approved mockups constructed in place. Incorporate fully into the Work.

PART 3 - EXECUTION (not used)

END OF SECTION 01 43 39

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SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

- A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

1.3 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
- B. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.
- C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- D. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
 - 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
 - 2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

3. Indicate methods to be used to avoid trapping water in finished work.

1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in ICC/ANSI A117.1.

1.5 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: 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.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

- A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
 3. Drinking water and private toilet.
 4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
 6. Internet Wireless Access Point with ready access to a security key or password for access to internet by wireless devices such as phones, tablets, computers, etc.

2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

3.2 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

- E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
 - 1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
- F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - 1. Install electric power service underground unless otherwise indicated.
- G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- H. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install WiFi cell phone access equipment for each field office.
- I. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.

3.4 SUPPORT FACILITIES INSTALLATION

- A. Comply with the following:
 - 1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E136. Comply with NFPA 241.
 - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
 - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.

- D. Parking: Provide temporary offsite parking areas for construction personnel.
- E. Storage and Staging: Provide temporary offsite area for storage and staging needs.
- F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
- G. Project Signs: Provide Project signs as indicated.
 - 1. Identification Signs: Provide Project identification signs as coordinated with Architect.
 - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
- H. Waste Disposal Facilities: Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."
- I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- B. Temporary Erosion and Sedimentation Control: Comply with requirements specified in Section 31 10 00 "Site Clearing."
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways.
 - 1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
 - 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 - 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
 - 4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
- G. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
 - 1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 - 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

- A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.
- B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
 - 1. Protect porous materials from water damage.
 - 2. Protect stored and installed material from flowing or standing water.
 - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 - 4. Remove standing water from decks.
 - 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
 - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 - 2. Keep interior spaces reasonably clean and protected from water damage.
 - 3. Periodically collect and remove waste containing cellulose or other organic matter.

4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard and replace stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

3.7 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00

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SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 01 25 00 "Substitution Procedures" for requests for substitutions.

1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
 - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
 - 1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
 - 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
 - 2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 01 33 00 "Submittal Procedures."
- F. Substitution: Refer to Section 01 25 00 "Substitution Procedures" for definition and limitations on substitutions.

1.3 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.4 PRODUCT 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.

1.5 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.

- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
 - 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
 - 4. Where products are accompanied by the term "as selected," Architect will make selection.
 - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. Product Selection Procedures:
 - 1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
 - 2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
 - 3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with

requirements. Comparable products or substitutions for Contractor's convenience will be considered.

- a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
 - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
 5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered.
 - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
 6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
 - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
 7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
 - a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 25 00 "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 01 33 00 "Submittal Procedures."

1. Form of Approval of Submittal: As specified in Section 01 33 00 "Submittal Procedures."
2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

D. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

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SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Coordination of Owner's portion of the Work.
 - 5. Coordination of Owner-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
 - 9. Correction of the Work.

- B. Related Requirements:
 - 1. Section 01 10 00 "Summary" for coordination of, Owner's separate contracts, and limits on use of Project site.
 - 2. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.

1.2 INFORMATIONAL SUBMITTALS

- A. Certificates: Submit certificate signed by professional engineer, certifying that location and elevation of improvements comply with requirements.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with requirements specified in other Sections.

- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.
- C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other construction affecting the Work.
1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
 2. List of detrimental conditions, including substrates.
 3. List of unacceptable installation tolerances.
 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 01 31 00 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.
- B. Engage a land surveyor experienced in laying out the Work, using the following accepted surveying practices:
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.5 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb, and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

- D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.
- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. 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.
- I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together

3.6 COORDINATION OF OWNER'S PORTION OF THE WORK

- A. Site Access: Provide access to Project site for Owner's construction personnel and Owner's separate contractors.
 - 1. Refer to Section 01 10 00 "Summary" for other requirements for Owner-furnished, Contractor-installed products
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's separate contractors.
 - 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.

3.7 PROGRESS CLEANING

- A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- C. Restore permanent facilities used during construction to their specified condition.
- D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

3.11 HAZARDOUS MATERIALS

- A. General: An environmental survey was performed of the existing facility to determine whether asbestos containing materials and lead based paint were present. Asbestos and lead-based paint was detected on isolated components of the building structure and systems and must be removed prior to the start of the new work.

1. Contractor shall determine the extent of asbestos and lead-based paint removal required by federal, state, county, and local agencies.
2. Removal and disposal of all asbestos and lead-based paint shall be completed on accordance with the applicable requirements of the U.S. Environmental Protection Agency, (EPA), the Occupational Safety and Health Administration (OSHA), and other federal, state, county and local agencies.
3. Refer to NOVA Engineering and Environmental Pre-Renovation Asbestos and Lead Survey report dated April 3, 2023, provided as Appendix A of the Project Specifications for additional information.

END OF SECTION 01 73 00

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Disposing of nonhazardous construction waste.
 - 2. Disposing of hazardous construction waste.

1.2 DEFINITIONS

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.

1.3 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.1 DISPOSAL OF NONHAZARDOUS WASTE

- A. General: Remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.

3.2 DISPOSAL OF HAZARDOUS WASTE

- A. Asbestos and lead-based paint must be disposed of in strict compliance with federal, state, county, and local agency requirements.
- B. Refer to NOVA Engineering and Environmental Pre-Renovation Asbestos and Lead Survey report dated April 3, 2023, provided as Appendix A of the Project Specifications for additional information.

END OF SECTION 01 74 19

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.

- B. Related Requirements:
 - 1. Section 01 78 23 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
 - 2. Section 01 78 39 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 3. Section 01 79 00 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest-control inspection.

1.4 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
 5. Submit testing, adjusting, and balancing records.
 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
 6. Advise Owner of changeover in utility services.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements.
 10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1.5 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
1. Submit a final Application for Payment in accordance with Section 01 29 00 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1.6 LIST OF INCOMPLETE ITEMS

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor, listed by room or space number.
 2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in the following format:
 - a. PDF Electronic File: Architect will return annotated file.
 - b. Utilize Architect's Web-Based Project Software Upload: Utilize software feature for creating and updating list of incomplete items (punch list).

1.7 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 - 1. Submit on digital PDF format by uploading to web-based project software site or by email to Architect.
- D. Warranties in Paper Form:
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
- E. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

- a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
 - b. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - c. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - d. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
 - e. Vacuum and mop concrete.
 - f. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - g. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - h. Remove labels that are not permanent.
 - i. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - j. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - k. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - l. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - m. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - n. Clean strainers.
 - o. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.
 - D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations required by Section 01 73 00 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 01 77 00

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SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

- B. Format: Submit operation and maintenance manuals in the following format:

1. Submit on digital media acceptable to Architect. Enable reviewer comments on draft submittals. OR:
2. Submit one paper copies. Architect will scan and return said copy.

- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

- D. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.3 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
 - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - 2. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.4 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- B. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.

6. Name and contact information for Construction Manager.
 7. Name and contact information for Architect.
 8. Name and contact information for Commissioning Authority.
 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 23

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SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record specifications.
 - 3. Record Product Data.
- B. Related Requirements:
 - 1. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set(s) of marked-up record prints.

1.3 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding photographic documentation.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations.
 - d. Locations and depths of underground utilities.

- e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
- 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 - 4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 39

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.3 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination."

1.4 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.5 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 - 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.

- f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

1.6 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

1.7 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- F. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 01 79 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Formwork for cast-in-place concrete, with shoring, bracing, and anchorage.
2. Formwork accessories.
3. Form stripping.
4. Reinforcing steel for cast-in-place concrete.
5. Cast-in-place concrete, including concrete for the following:
 - a. Foundations, footings.
 - b. Slabs on grade.
 - c. Equipment pads and bases.
6. Concrete curing.

1.02 RELATED DOCUMENTS:

- ##### A. Drawings and general provisions of Contract, including General and Supplementary Conditions and technical specification sections, apply to work of this section.

1.02 DEFINITIONS

- ##### A. Unexposed Finish: A general-use finish, with no appearance criteria, applicable to all formed concrete concealed from view after completion of construction.
- ##### B. Exposed Finish: A general-use finish applicable to all formed concrete exposed to view and including surfaces which may receive a paint coating (if any).

1.03 SUBMITTALS

- ##### A. Shop Drawings: Submit shop drawings for fabrication and placement of the following:
1. Reinforcement: Comply with ACI SP-66. Include bar schedules, diagrams of bent bars, arrangement of concrete reinforcement, and splices. Show construction joints.
- ##### B. Quality Control Submittals: Submit the following information related to quality assurance requirements specified: Design data: Submit proposed mix designs and test data before concrete operations begin. Identify for each mix submitted the method by which proportions have been selected.
1. For mix designs based on field experience, include individual strength test results, standard deviation, and required average compressive strength ($f'c$) calculations.
 2. For mix designs based on trial mixtures, include trial mix proportions, test results, and graphical analysis and show required average compressive strength ($f'c$).
 3. Indicate quantity of each ingredient per cubic yard of concrete.
 4. Indicate type and quantity of admixtures proposed or required.
 5. Test reports: Submit laboratory test reports for all testing specified.

6. Certifications: Submit affidavits from an independent testing agency certifying that all materials furnished under this section conform to specifications.
7. Certifications: Provide certification from manufacturers of concrete admixtures that chloride content complies with specified requirements.
8. Submit batch tickets complying with ASTM C 685 or delivery tickets complying with ASTM C 94, as applicable, for each load of concrete used in the work.

1.04 QUALITY ASSURANCE

- A. Codes and Standards: Comply with the following documents, except where requirements of the contract documents or of governing authorities are more stringent:
 1. ACI 301.
 2. ACI 318.
 3. CRSI Manual of Standard Practice.
- B. Testing Agency Services:
 1. Employ, at owner's expense, an independent testing agency acceptable to the Architect to perform specified tests and other services required for quality assurance.
 - a. Testing agency shall meet ASTM E 329 requirements.
- C. Source of Materials: Obtain materials of each type from same source for the entire project.

1.05 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at [Project site] <Insert location>.
 1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete Subcontractor.
 - e. Special concrete finish Subcontractor.
 2. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction joints, control joints, isolation joints, and joint-filler strips.
 - c. Semirigid joint fillers.
 - d. Vapor-retarder installation.
 - e. Anchor rod and anchorage device installation tolerances.
 - f. Cold and hot weather concreting procedures and ACI Standards.
 - g. Concrete finishes and finishing.
 - h. Curing procedures.
 - i. Forms and form-removal limitations.
 - j. Shoring and reshoring procedures.
 - k. Methods for achieving specified floor and slab flatness and levelness.
 - l. Floor and slab flatness and levelness measurements.
 - m. Concrete repair procedures.
 - n. Concrete protection.
 - o. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
 - p. Protection of field cured field test cylinders.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver reinforcement to project site bundled and tagged with metal tags indicating bar size, lengths and other data corresponding to information shown on placement drawings.
 - 1. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or rust.
 - 2. Store cementitious materials in a dry, weather tight location. Maintain accurate records of shipment and use.
- B. Store aggregates to permit free drainage and to avoid contamination with deleterious matter or other aggregates. When stockpiled on ground, discard bottom 6 inches of pile.
- C. Handle aggregates to avoid segregation.

PART 2 - PRODUCTS

2.01 FORM WORK

- A. Facing Materials:
 - 1. Unexposed finish concrete: Any standard form materials that produce structurally sound concrete. Exposed finish concrete: Materials selected to offer optimum smooth, stain-free final appearance and minimum number of joints. Provide materials with sufficient strength to resist hydrostatic head without bow or deflection in excess of allowable tolerances, and as follows:
 - a. Plywood: PS-I "B-B (Concrete Form) Plywood", Class I, Exterior Grade, mill-oiled and edge sealed.
- B. Form Work Accessories:
 - 1. Form coating: Form release agent that will not adversely affect concrete surfaces or prevent subsequent application of concrete coatings.
 - 2. Metal ties: Commercially manufactured types; cone snap ties, taper removable bolt, or other type which will leave no metal closer than 1-1/2 inches from surface of concrete when forms are removed, leaving not more than a 1 inch diameter hole in concrete surface.
 - 3. Fillets: Wood or plastic fillets for chamfered corners, in maximum lengths possible.

2.02 REINFORCING MATERIALS

- A. Reinforcing Bars: Provide deformed bars complying with the following, except where otherwise indicated: ASTM A 615, Grade 60.
- B. Welded Wire Fabric: ASTM A 185, cold-drawn steel, plain.
- C. Reinforcing Accessories:
 - 1. Tie wire: Black annealed type, 16-1/2 gage or heavier.
 - 2. Supports: Bar supports conforming to specifications of CRSI "Manual of Standard Practice".
 - Class I (plastic protected) at all formed surfaces which will be exposed to weather.
 - Class 1 (plastic protected) or Class 2 (stainless steel protected) at all formed surfaces which will be exposed to view but not to weather.
 - Precast concrete blocks of strength equal to or greater than specified strength of concrete or Class 3 supports equipped with sand plates, where concrete will be cast against earth. Concrete masonry units will not be accepted.

2.03 CONCRETE MATERIALS

CAST-IN-PLACE CONCRETE

- A. Portland Cement: ASTM C 150, and as follows:
 - 1. Type I or I/II.
 - 2. Fly Ash: Not to be used.
 - 3. Water: Potable
- B. Aggregates:
 - 1. Normal weight concrete: ASTM C 33.
 - a. Class IN.
 - b. Gradation as specified below under mix design.
- C. Admixtures - General: Admixtures which result in more than 0.1 percent of soluble chloride ions by weight of cement are prohibited.
- D. Air-Entraining Admixture: ASTM C 260 and certified by manufacturer for compatibility with other mix components.
- E. Water-Reducing Admixture: ASTM C 494, Type A.

2.04 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Waterstops, General: Provide waterstops at construction joints and as otherwise indicated, sized and configured to suit joints.
 - 1. Polyvinyl chloride waterstops: Corps of Engineers CRD-C 572.
- B. Vapor Retarder: Membrane for installation beneath slabs on grade, resistant to decay when tested in accordance with ASTM E 154, and as follows:
 - 1. 15 mil polyethylene.
- C. Nonshrink Grout: ASTM C 1107.
 - 1. Type: Provide nonmetallic type only.
- D. Burlap: AASHTO M 182, Class 2 jute or kenaf cloth.
- E. Moisture-Retaining Cover: ASTM C 171, and as follows:
 - 1. Curing paper.
 - 2. Polyethylene film.
 - 3. White burlap-polyethylene sheeting.
- F. Liquid Curing Compounds:
 - 1. Material - curing compounds: Comply with ASTM C 309, Type I.
 - a. Non-yellowing formulation where subject to ultraviolet light.
 - b. Curing and sealing compound: Where indicated, provide curing and sealing formulation with long-lasting finish that is resistant to chemicals, oil, grease, deicing salts, and abrasion.
- G. Bonding Compound: Non-redispersable acrylic bonding admixture, ASTM C 1059, Type II.
- H. Epoxy Bonding Systems: ASTM C 881; type, grade and class as required for project conditions.

2.05 CONCRETE MIX DESIGN

- A. Review: Do not begin concrete operations until proposed mix has been reviewed by the Architect.
- B. Proportioning of Normal Weight Concrete: Comply with recommendations of ACI 211.1.
- C. Required Average Strength: Establish the required average strength f_{cr} of the design mix on the basis of either field experience or trial mixtures as specified in ACI 301, and proportion mixes accordingly. If trial mixtures method is used, employ an independent testing agency acceptable to the Architect for preparing and reporting proposed mix design.
- D. Admixtures:
 - 1. Air-entraining admixture: Add at rate to achieve specified air content.
 - a. Do not use in slabs-on-grade scheduled to receive topping, unless manufacturer of topping recommends use over air-entrained concrete.
 - 2. Water-reducing admixture: Add as required for placement and workability.
 - 3. Do not use admixtures not specified or approved.
- E. Design mix to meet or exceed each requirement specified. Where more than one criterion is specified, the most stringent shall apply. For example, a minimum cement content or maximum water-cement ratio may be required in order to achieve the required strength.
 - 1. Specified compressive strength (f'_c) (ASTM C 39): 4000 psi at 28 days (See Drawings). Maximum water-cement ratio by weight: 0.46 maximum for air-entrained concrete. Maximum slump: 4" \pm 1"
 - 2. Maximum nominal size of coarse aggregate: As recommended in ACI 211.1.
 - 3. Total maximum air content (ASTM C 173 or ASTM C 231): 3 percent.
- F. Mix adjustments: Provided that no additional expense to owner is involved, contractor may submit for Architect's approval requests for adjustment to approved concrete mixes when circumstances such as changed project conditions, weather or unfavorable test results occur. Include laboratory test data substantiating specified properties with mix adjustment requests.

2.06 CONTROL OF MIX IN THE FIELD

- A. Slump: A tolerance of up to 1 inch above that specified will be permitted for 1 batch in 5 consecutive batches tested. Concrete of lower slump than that specified may be used, provided proper placing and consolidation is obtained.
 - 1. No addition of water will be acceptable after initial batching of the concrete at the batching plant.

- B. Do not use batches that exceed tolerances.

2.07 CONCRETE MIXING

- A. On-Site Equipment: Mix concrete materials in appropriate drum type batch machine mixer, in compliance with ASTM C 685. Mix each batch minimum of 1-1/2 minutes and maximum of 5 minutes before discharging concrete. Clean thoroughly at end of day and before changing concrete type.
- B. Transit Mixers: Mix concrete materials in transit mixers, complying with requirements of ASTM C 94.

PART 3 - EXECUTION

3.01 CONCRETE FORM PREPARATION

- A. General: Comply with requirements of ACI 301 for form work, and as herein specified. The contractor is responsible for design, engineering, and construction of form work, and for its timely removal.
- B. Earth Forms: Hand-trim bottoms and sides of earth forms to profiles indicated on the drawings. Remove loose dirt before placing concrete.
- C. Design: Design and fabricate forms for easy removal, without impact, shock, or damage to concrete surfaces or other portions of the work. Design to support all applied loads until concrete is adequately cured, within allowable tolerances and deflection limits.
- D. Construction: Construct and brace form work to accurately achieve end results required by contract documents, with all elements properly located and free of distortion. Provide for necessary openings, inserts, anchorages, and other features shown or otherwise required.
 - 1. Joints: Minimize form joints and make watertight to prevent leakage of concrete.
 - 2. Align joints symmetrically at exposed conditions.
 - 3. Chamfers: Provide chamfered edges and comers at exposed locations, unless specifically indicated otherwise on the drawings.
 - 4. Permanent openings: Provide openings to accommodate work of other trades, sized and located accurately. Securely support items built into forms; provide additional bracing at openings and discontinuities in form work.
 - 5. Temporary openings: Provide temporary openings for cleaning and inspection in most inconspicuous locations at base of forms, closed with tight-fitting panels designed to minimize appearance of joints in finished concrete work.
- E. Tolerances for Formed Surfaces: Comply with minimum tolerances established in ACI 117, unless more stringent requirements are indicated on the drawings.
- F. Release Agent: Provide either form materials with factory-applied nonabsorptive liner or field-applied form coating. If field-applied coating is employed, thoroughly clean and recondition form work and reapply coating before each use. Rust on form surfaces is unacceptable.
- G. SLOPE CONCRETE SLABS TO FLOOR DRAINS AS SHOWN ON THE DRAWINGS. Slab surfaces that are not properly sloped to floor drains (at least 1/8" per foot) will be required to be removed and replaced.

3.02 VAPOR RETARDER INSTALLATION

- A. General: Place vapor retarder sheet over prepared base material, aligning longer dimension parallel to direction of pour and lapped 6 inches. Seal joints with appropriate tape.

3.03 PLACING REINFORCEMENT

- A. General: Comply with requirements of ACI 301 and as herein specified.
- B. Preparation: Clean reinforcement of loose rust and mill scale, soil, and other materials which adversely affect bond with concrete.

- C. Placement: Place reinforcement to achieve not less than minimum concrete coverages required for protection. Accurately position, support, and secure reinforcement against displacement. Provide Class C tension lap splices complying with ACI 318 unless otherwise indicated. Do not field-bend partially embedded bars unless otherwise indicated or approved.
1. Use approved bar supports and tie wire, as required. Set wire ties to avoid contact with or penetration of exposed concrete surfaces. Tack welding of reinforcing is not permitted.
 2. Wire fabric: Install in maximum lengths possible, lapping adjoining pieces not less than one full mesh. Offset end laps to prevent continuous laps in either direction, and splice laps with tie wire.
- D. Exterior Concrete Slabs: All exterior slabs, walkways, driveways and pads shall be reinforced with wire fabric and placed over vapor barrier.

3.04 JOINT CONSTRUCTION

- A Construction Joints: Locate and install construction joints as indicated on drawings. If construction joints are not indicated, locate in manner which will not impair strength and will have least impact on appearance, as acceptable to the Architect. The surface of concrete construction joints shall be cleaned and laitance removed. Immediately before new concrete is placed, construction joints shall be wetted and standing water removed.
1. Keyways: Provide keyways not less than 1-1/2 inches deep.
 2. Reinforcement: Continue reinforcement across and perpendicular to construction joints, unless details specifically indicate otherwise.
 3. Waterstops: Provide waterstops as indicated, installing to form continuous, watertight dam, with field joints fabricated in strict accordance with manufacturer's instructions.
- B. Control Joints: Construct contraction joints in slabs poured on grade to form panels of sizes indicated on drawings, but not more than 15 feet apart in either direction.
1. Saw cuts: Form control joints by means of saw cuts one-fourth the depth of the slab, performed within 12 hours after slab finishing without dislodging aggregate.

3.05 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set anchorage devices and other items required for other work connected to or supported by cast-in-place concrete, using templates, setting drawings, and instructions from suppliers of items to be embedded.
1. Edge Forms and Screeds: Set edge forms and intermediate screeds as necessary to achieve elevations indicated for finished slab surfaces.

3.06 CONCRETE PLACEMENT

- A. Inspection: Before beginning concrete placement, inspect form work, reinforcing steel, and items to be embedded, verifying that all such work has been completed.
1. Wood forms: Moisten immediately before placing concrete in locations where form coatings are not used.
- B. Placement - General: Comply with requirements of ACI 304 and as follows:
1. Schedule continuous placement on concrete to prevent the formation of cold joints.
 2. Provide construction joints if concrete for a particular element or component cannot be placed in continuous operation.
 3. Deposit concrete as close as possible to its final location, to avoid segregation.

- C. Placement in Forms: Limit horizontal layers to depths which can be properly consolidated, but in no event greater than 24 inches.
 - 1. Consolidate concrete by means of mechanical vibrators, inserted vertical in freshly placed concrete in a systematic pattern at close intervals. Penetrate previously placed concrete to ensure that separate concrete layers are knitted together.
 - 2. Vibrate concrete sufficiently to achieve consistent consolidation without segregation of coarse aggregates. Do not use vibrators to move concrete laterally.

- D. Slab Placement: Schedule continuous placement and consolidation of concrete within planned construction joints. Thoroughly consolidate concrete without displacing reinforcement or embedded items, using internal vibrators, vibrating screeds, roller pipe screeds, or other means acceptable to Architect. Strike off and level concrete slab surfaces, using highway straightedges, darbies, or bull floats before bleed water can collect on surface. Do not work concrete further until finishing operations are commenced.

3.07 FINISHING FORMED SURFACES

- A. Repairs - General: Repair surface defects, including tie holes, immediately after removing form work.
 - 1. Remove honeycombed areas and other defective concrete down to sound concrete, cutting perpendicular to surface or slightly undercutting. Dampen patch location and area immediately surrounding it prior to applying bonding compound or patching mortar.

 - 2. Before bonding compound has dried, apply patching mixture matching original concrete in materials and mix except for omission of coarse aggregate, and using a blend of white and normal portland cement as necessary to achieve color match. Consolidate thoroughly and strike off slightly higher than surrounding surface.

- B. Unexposed Form Finish: Repair tie holes and patch defective areas. Rub down or chip off forms or other raised areas exceeding 1/4 inch height.

- C. Exposed Form Finish: Repair and patch defective areas, with fins or other projections completely removed and smoothed.
 - 1. Smooth rubbed finish: Apply to surfaces indicated no later than 24 hours after form removal.
 - a. Wet concrete surfaces to be finished and rub with Carborundum brick or other abrasive until uniform color and texture are achieved.
 - b. Do not apply separate grout mixture.
 - 2. Contiguous unformed surfaces: Strike smooth and float to a similar texture tops of walls, horizontal offsets, and other unformed surfaces. Continue final finish of formed surfaces across unformed surfaces, unless otherwise specifically indicated.

- D. SLOPE CONCRETE SLABS TO FLOOR DRAINS AS SHOWN ON THE DRAWINGS. Slab surfaces that are not properly sloped to floor drains (at least 1/8" per foot) will be required to be removed and replaced.

3.08 FINISHING SLAB

- A. Finishing Operations - General:
1. Do not directly apply water to slab surface or dust with cement.
 2. Use hand or powered equipment only as recommended in ACI 302.1R.
 3. Screeding: Strike off to required grade and within surface tolerances indicated. Verify conformance to surface tolerances. Correct deficiencies while concrete is still plastic.
 4. Bull Floating: Immediately following screeding, bull float or darby before bleed water appears to eliminate ridges, fill in voids, and embed coarse aggregate. Recheck and correct surface tolerances.
 5. Do not perform subsequent finishing until excess moisture or bleed water has disappeared and concrete will support either foot pressure with less than 1/4 inch indentation or weight of power floats without damaging flatness.
 6. Final Floating: Float to embed coarse aggregate, to eliminate ridges, to compact concrete, to consolidate mortar at surface, and to achieve uniform, sandy texture. Recheck and correct surface tolerances.
 7. Trowel Finish: All slabs that receive resilient floor coverings shall be trowel finished.
- B. Coordinate appearance and texture of required final finishes with the Architect before application.
1. Apply final finishes in the locations indicated on the drawings.
- C. Float Finish: As specified above.
- D. Slab Surface Tolerances:
1. Achieve flat, level planes except where grades are indicated. Slope uniformly to drains. Slabs that are not properly sloped to drains will be saw-cut, removed and re-poured to the satisfaction of the Architect.
 2. Floated and trowel finishes: Depressions between high spots shall not exceed 1/8 inch under a 10 foot straightedge.
- E. Repair of Slab Surfaces: Test slab surfaces for smoothness and to verify surface plane to tolerance specified.
1. Repair defects as follows:
 - a. High areas: Correct by grinding after concrete has cured for not less than 14 days.
 - b. Low areas: Immediately after completion of surface finishing operations, cut out low areas and replace with fresh concrete. Finish repaired areas to blend with adjacent concrete.
 - c. Proprietary patching compounds may be used when approved by the Architect.
 2. Crazed or cracked areas: Cut out 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. Dampen exposed concrete and apply bonding compound. Mix, place, compact and finish patching concrete to match adjacent concrete.
 3. Isolated cracks and holes: Groove top of cracks and cut out holes not over 1 inch in diameter. Dampen cleaned concrete surfaces and apply bonding compound; place dry pack or proprietary repair compound acceptable to Architect while bonding compound is still active:
 - a. Dry-pack mix: one part portland cement to 2-1/2 parts fine aggregate and enough water as required for handling and placing.
 - b. Install patching mixture and consolidate thoroughly, striking off level with and matching surrounding surface. Do not allow patched areas to dry out prematurely.

3.09 CONCRETE CURING AND PROTECTION

A. General:

1. Prevent premature drying of freshly placed concrete, and protect from excessively cold or hot temperatures until concrete has cured.
2. Provide curing of concrete by one of the methods listed and as appropriate to service conditions and type of applied finish in each case.

B. Curing Period:

1. Not less than 7 days for standard cements and mixes.

C. Formed Surfaces: Cure formed concrete surfaces by moist curing with forms in place for full curing period or until forms are removed.

1. Keep wooden or metal forms moist when exposed to heat of the sun.
2. If forms are removed prior to completion of curing process, continue curing by one of the applicable methods specified.

D. Surfaces Not in Contact with Forms:

1. Start curing as soon as free water has disappeared, but before surface is dry. Place to protect adjacent concrete edges. Acceptable curing methods:
 - a. Water ponding.
 - b. Water-saturated sand.
 - c. Water-fog spray.
 - d. Saturated burlap: provide 4-inch minimum overlap at joints.
 - e. Moisture-retaining cover: Lap not less than 3-inches at edges and ends, and seal with waterproof tape or adhesive. Repair holes or tears during curing period with same tape or adhesive. Maintain covering in intimate contact with concrete surface. Secure to avoid displacement.
 1. Extend covering past slab edges at least twice the thickness of the slab.
 2. Do not use plastic sheeting on surfaces which will be exposed to view when in service.
 3. Curing compound: Apply at rate stated by manufacturer to conform with moisture-retention requirements specified, using second, immediate application at right angles to first, if necessary, and reapply if damaged by rain.
 4. Curing and sealing compound: Apply at rate stated by manufacturer to conform with moisture-retention requirements specified, using second, immediate application at right angles to first, if necessary, and reapply if damaged by rain. Apply additional coat near substantial completion to act as sealer.
 5. Use curing compounds only in locations permitted or required. Do not apply to surfaces to receive other finishes, coating, or coverings.

E. Avoid rapid drying at end of curing period.

- F. General: Comply with recommendations of ACI 347 for shoring and reshoring in multistory construction.

3.10 REMOVAL OF FORMS AND SUPPORTS

- A. Non-Load-Bearing Form Work: Provided that concrete has hardened sufficiently that it will not be damaged, forms not actually supporting weight of concrete or weight of soffit forms may be removed after concrete has cured at not less than 50 degrees F for 24 hours. Maintain curing and protection operations after form removal.
- B. Test field-cured specimens to determine potential compressive strength of concrete for specific locations.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Fill-in: Fill in holes and openings left in concrete structures for passage of work by other trades after such work is in place. Place such fill-in concrete to blend with existing construction, using same mix and curing methods.
- B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as indicated on drawings. Set anchor bolts at correct elevations, complying with diagrams or templates of equipment
- C. Manufacturer.
 - 1. Grout base plates and foundations as indicated with nonshrink grout.
 - 2. Use nonmetallic grout for exposed conditions, unless otherwise indicated.

3.12 CONCRETE REPAIRS

- A. Perform cosmetic repairs of concrete surfaces as specified under concrete application.
- B. Perform structural repairs with prior approval of the Architect for method and procedure, using epoxy bonding systems. The Architect's approval is required for repair methods using materials other than those specified.

3.13 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. Concrete: Composite Sampling and Making and Curing of Specimens: ASTM C 172 and ASTM C 31.
 - 1. Take samples at point of discharge.
 - 2. For pumped concrete, perform sampling and testing at the frequencies specified herein at point of delivery to pump, and perform additional sampling and testing at the same frequency at discharge from line. Results obtained at discharge from line shall be used for acceptance of concrete.
- B. Slump: ASTM C 143. One test per strength test and additional tests if concrete consistency changes. Modify sampling to comply with ASTM C 94.
- C. Air Content of Normal Weight Concrete: ASTM C 173 or ASTM C 231. One test per strength test

performed on air-entrained concrete.

D. Concrete Temperature:

Test each time a set of strength test specimens is made.

E. Compressive Strength Tests: ASTM C 39.

1. Compression test specimens: Mold and cure one set of 4 standard cylinders for each compressive strength required.
2. Testing for acceptance of potential strength of as-delivered concrete:
 - a. Obtain samples on a statistically sound, random basis.
 - b. Minimum frequency:
 1. One set for first 24 cubic yards of concrete, then per 100 cubic yards or fraction thereof for each day's pour of each concrete class.
 2. One set per 3500 square feet of slab or wall area or fraction thereof for each day's pour of each concrete class.
 3. When the above testing frequency would provide fewer than 5 strength tests for a given class of concrete during the project, conduct testing from not less than 5 randomly selected batches, or from each batch if fewer than five.
3. Test one specimen per set at 7 days for information unless an earlier age is required.
4. Test 2 specimens per set for acceptance of strength potential; test at 28 days unless other age is specified. The test result shall be the average of the two specimens. If one specimen shows evidence of improper sampling, molding, or testing, the test result shall be the result of the remaining specimen; if both show such evidence, discard the test result and inform the Architect. Retain one specimen from each set for later testing, if required.
5. Strength potential of as-delivered concrete will be considered acceptable if all of the following criteria are met.
 - a. No individual test result falls below specified compressive strength by more than 500 psi. Not more than 10 percent of individual test results fall below specified compressive strength ($f'c$).
 - b. Average of any 3 consecutive strength test results equals or exceeds specified compressive strength ($f'c$).
6. Evaluate construction and curing procedures and implement corrective action when strength results for field-cured specimens are less than 85 percent of test values for companion laboratory-cured specimens.

F. Test Results: Testing agency shall report test results in writing to Architect and contractor within 24 hours of test.

1. Test reports shall contain the following data:
 - a. Project name, number, and other identification.
 - b. Name of concrete testing agency.
 - c. Date and time of sampling.
 - d. Concrete type and class.
 - e. Location of concrete batch in the completed work.
 - f. All information required by respective ASTM test methods.

2. Nondestructive testing devices such as impact hammer or sonoscope may be used at Architect's option for assistance in determining probable concrete strength at various locations or for selecting areas to be cored, but such tests shall not be the sole basis for acceptance or rejection.
 3. The testing agency shall make additional test of in-place concrete as directed by the Architect when test results indicate that specified strength and other concrete characteristics have not been attained.
 - a. Testing agency may conduct tests of cored cylinders complying with ASTM C 42, or tests as directed.
 - b. Cost of additional testing shall be borne by the contractor when unacceptable concrete has been verified.
- G. Grout: Test grout compressive strength per ASTM C 1019 for each 500 square feet of wall area or portion thereof.

END OF SECTION 03 30 00

SECTION 04 20 00 - CONCRETE MASONRY

PART 1 - GENERAL

1.01 APPLICABLE CODES AND STANDARDS

- A. Florida Building Code - latest edition adopted in building area.
Building Code Requirements for Masonry Structures (ACI 530-13 / TMS 402-16).
Specification for Masonry Structures (ACI 530-13 / ASCE 6-99 / TMS 602-99).

1.02 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General, Supplementary, and Special Conditions and Division 1 specification sections, apply to work of this section.

PART 2 - PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. STANDARD WEIGHT CONCRETE MASONRY UNITS

1. Conform to ASTM C90-01a, grade "N", Type II, 8" x 16" modular units, thickness as indicated on the drawings, minimum 1" face shells. Units 8" or more thick must have minimum 1 1/4" face shells. Aggregate is to be gravel, air-cooled blast furnace slag, or crushed stone. Units are to be acceptable visually, structurally, and free from undesirable defects resulting from either manufacturer or handling, as judged by ARCHITECT.
2. The design compressive strength of the masonry, f'm = 2000 psi minimum.
3. Units which have not been subjected to an approved method of steam curing must be stored for 30 days prior to use.
4. Sound transmission loss through 4" unpainted unplastered wall, must not measure less than 36 decibels.
5. Linear drying shrinkage must not be greater than 0.04% when tested as prescribed by National Bureau of Standards.
6. Moisture content at time of delivery must not exceed 75% of relative humidity, as measured by approved methods of Portland Cement Association.
7. Standard brick sized units are to be solid, but otherwise conform to these paragraphs.

B. ACCESSORY UNITS

1. 8" x 16" x 8" thick header block at locations indicated.
2. 8" x 16" knock out cut-lintel units, thickness as indicated.
3. Furnish regular corner, half, and half corner units; and all lintel and half block units as required by conditions shown on architectural and structural drawings.

2.02 GROUT MATERIALS

- A. General and 03 30 00/Cast-In-Place Concrete.

2.07 MORTAR PREPARATION

- A. Conform to ASTM C270 for procedures. Proportion as Florida Building Code, Type N, for concrete masonry, use a one bag mix as follows:
 - 3 bags high strength masonry cement
 - 13.5 – 5 gallon buckets sand.

2.08 PRECAST LINTELS

- A. High strength precast and pre-stressed concrete lintels designed to be used unfilled or filled to form a composite reinforced concrete beam using concrete masonry units equal to 'Cast-Crete'. Calculations for lintels shall be prepared by the Specialty Engineer and submitted to the Architect and Engineer for review if deviation from the Construction Documents.

PART 3 - EXECUTION

3.01 GENERAL

- A. Conform to referenced codes.
- B. No wetting of concrete masonry units is permitted. All openings in walls to have concrete-filled reinforced lintels, unless otherwise indicated on drawings.
- C. COVER INCOMPLETE WORK DAILY AND AS REQUIRED TO PROTECT FROM RAIN AND DUST.

3.02 COURSING AND JOINTING

- A. Concrete Masonry - Lay all units plumb and true to line, with uniform 3/8" joints, and in running bond. Joints wider than 3/8" will be rejected. Lay to course out at 8 inch centers.
- B. Strike all joints flush, after mortar has partially set, and sack or float walls head joints to give smooth uniform appearance and tool all horizontal joints concave where walls are to be left exposed. At stucco or hard tile locations delete tooling of joints.

3.03 LAYING MASONRY UNITS

- A. For bonding masonry to concrete foundation or floor slabs, concrete to be clean with laitance removed and aggregate exposed.
- B. Lay starting joint with full mortar coverage on the joint; except that areas where grout occurs are to be free of mortar so that grout will contact concrete.
- C. Units shall be laid to preserve vertical continuity of cells to be filled. The vertical alignment shall be sufficient to maintain a clean, unobstructed flue measuring not less than 3"x3". Place no units or cut pieces of masonry less than 4" nominal.
- D. In placing mortar in horizontal joints, completely cover the face shells of each unit with mortar. Solidly fill all head joints to the thickness of the face shell and shove units tightly in place. Solidly bed in mortar all head and cross web bed joints adjacent to cells to be grouted to prevent leakage of mortar.

- E. Lay designated walls in two separate wythes, with insulated cavity as indicated.
- F. Anchor and bond intersecting masonry walls with 50% masonry bond, except as noted otherwise on drawings.
- G. Install precast and/or composite steel lintels over all openings (if required). Set lintels in place with joints pointed to match adjacent work. Build in lintels, reinforce and fill with structural concrete grout as work progresses.
 - 1. Steel lintels shall be provided with 6" minimum structural bearing each side of openings. All exterior lintels shall be hot dip galvanized prior to installation.
 - 2. Pre-cast concrete lintels shall be provided with 8" minimum structural bearing each side of openings.
 - 3. Typical steel and cut masonry lintels, even if not shown on structural or architectural drawings, shall be reinforced with a minimum of 2 #5 bar continuous (extend 12" minimum each end) and grouted solid.
 - 4. Concrete masonry work shall not proceed beyond the elevation of door and window headers until all vertical reinforced cells and reinforced horizontal lintels have been grouted.
- H. At hard tile locations take extra care in laying units such that wall will be suitable for thinset tile installation directly to wall. Grind any unevenness judged unacceptable by ARCHITECT.
- I. Install wall control/expansion joints at 20 ft. o.c. and/or as shown and detailed on architectural/engineering drawings. Refer to Sections 04000/Masonry, General and 07920/Sealants, Caulking and Seals for additional requirements.

3.04 CUTTING

- A. Do all cutting of block with carborundum or equivalent saw. To facilitate proper coursing, half blocks may be used to reduce amount of cutting. No masonry will be permitted to be used if not cut properly. Masonry broken by "blows" will be replaced, even if found after the wall has been completed.

3.05 PLACING STEEL REINFORCEMENT

- A. Reinforcing steel to be straight, except for bends around corners and as detailed otherwise on drawings. Lap reinforcing steel 48 bar diameters minimum. Place vertical bars in exact center of cells, or as otherwise indicated, and hold in position at top and bottom and at intervals not to exceed 96 bar diameters. Vertical cavity rebar to be run in maximum possible lengths, 5'-0" minimum, using low lift grouting procedures.
- B. Completely embed joint reinforcement in mortar or grout. Lap splices 6 inches minimum at all locations.
- C. Lap dowels in footings to vertical steel in masonry columns by placing in aligned cells, then grouting cells to obtain bonded lap between wall and footings.
- D. Reinforce and grout all reinforced horizontal block courses, as wall is built-up.

3.06 PLACING GROUT

- A. Insure all walls are cured minimum of three (3) days, and are solid, or braced against movement, during grouting. No one is to "walk" the walls. Notify ARCHITECT minimum of 24 hours or one full working day before start of each grouting operation.
- B. CONTRACTOR is to use only low-lift grouting procedure unless otherwise authorized by ARCHITECT and OWNER.
 - 1. Grout lifts that exceed 5'-0" must have prior approval of the OWNER. Contractor shall neatly saw-cut cleanout/inspection holes or provide manufactured inspection blocks at the bottom of all reinforced vertical cells for grout lifts greater than 5'-0".
- C. Grouting of reinforced vertical cells shall occur at intervals to allow grouting of all composite steel and/or precast lintels. Concrete masonry shall not be installed above lintels prior to grouting of all lintels.
- D. Consolidate all grout at time of pouring by puddling or vibrating and then reconsolidate by again puddling later before plasticity is lost. Stop grout pour 1 1/2" below top unit to form construction joint for subsequent pours. Neatly sawcut and provide cleanout/inspection hole at the bottom of all cells to be filled with grout when pour, if authorized, exceeds 5'-0" in height.
- E. CONTRACTOR has sole responsibility of completing masonry and grouting operations necessary to construct a sound load-bearing crack-free wall.
- F. Properly cure grout placed in horizontal reinforced precast concrete lintels minimum seven (7) days.

3.07 All masonry walls, if not receiving a formed and poured concrete beam at top and even if not shown on structural or architectural drawings, are to receive, as a minimum, a two top knockout lintel block course reinforced with 2 #5 bar continuous and filled with concrete grout for a total depth of 16" beam.

3.08 WATERPROOFING

- A. Refer to Division 7 for waterproof coating installed over concrete and masonry surfaces behind face veneer and elsewhere.
- B. Masonry CONTRACTOR is responsible for providing a uniformly regular surface prior to application of coating, with full and tight joints between concrete block units and around all brick ties or other embedded items. Remove projecting mortar and fill all joints and voids.

3.09 FIELD QUALITY CONTROL

- A. Inspectors: At the Owner's expense, the Owner shall engage a professional engineer registered in the State of Florida to perform inspections and prepare reports.
- B. The Contractor shall provide Level B Quality Assurance Testing per the requirements of ACI 530. This shall include but is not limited to providing the following continuously during the construction of masonry.
 - 1. Proportions of site mixed mortar and grout.
 - 2. Grade and size of reinforcement and anchorages
 - 3. Grout space

4. Placement of reinforcement, connectors and anchorages.
 5. Proportions of site-prepared grout
 6. Construction of mortar joints
 7. Observe preparation of grout specimens, mortar specimens, and prisms.
 8. Verify compliance with the required inspection provisions of the contract documents and the approved submittals
- C. Testing Agency: Contractor will engage a qualified accredited (or approved equivalent) testing agency to perform field tests indicated below and prepare test reports:
- D. Payment for these services will be made by Contractor
- E. Testing Frequency: One set of tests for each 500 sq. ft. of wall area or portion thereof.
- F. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.
- G. Mortar Test (Property Specification): For each mix provided, per ASTM C 780.
- H. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019. Field testing shall be provided for every 20 cubic yards of grout placement. Testing results shall be provided to the Architect / Engineer for review. At minimum provide (6) cubes sampled for each test.
- I. All adhesive anchorage systems shall be tested at the Contractors expense. See structural "General Notes" for minimum testing frequency and loading requirements.

END OF SECTION 04 20 00

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Grout.

B. Related Requirements:

1. Section 05 12 13 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.

1.2 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication of structural-steel components including all connections.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator, and testing agency.
- B. Welding certificates.
- C. Mill test reports for structural steel, including chemical and physical properties.
- D. Source quality-control reports.
- E. Field quality-control and special inspection reports.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 360.
 - 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using schematic details indicated and AISC 360.
 - 2. Use Allowable Stress Design; data are given at service-load level.
- B. Construction: Shear wall system.

2.2 STRUCTURAL-STEEL MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. W-Shapes: ASTM A 992/A 992M.
- C. Channels, Angles: ASTM A 36/A 36M.
- D. Plate and Bar: ASTM A 36/A 36M.
- E. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
- G. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M, Type 10.9), compressible-washer type with plain finish.
- C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- D. Un-headed Anchor Rods: ASTM F 1554, Grade 55, weldable.
 - 1. Configuration: Straight.
 - 2. Finish: Plain.
- E. Headed Anchor Rods: ASTM F 1554, Grade 55, weldable, straight.
 - 1. Finish: Plain.
- F. Threaded Rods: ASTM A 36/A 36M.
 - 1. Finish: Plain.

2.4 PRIMER

- A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Primer: Comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Primer: SSPC-Paint 25, Type I, zinc oxide, alkyd, linseed oil primer.
- D. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.5 GROUT

- A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
- B. 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/D1.1M and manufacturer's written instructions.

2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.8 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 of high-strength bolted, slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 5. Galvanized surfaces.
 - 6. Surfaces enclosed in interior construction.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
 - 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."

- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.9 SOURCE QUALITY CONTROL

- A. Testing Agency: The Contractor shall engage a qualified testing agency to perform shop tests and inspections, this testing agency shall be approved by the Architect/ Owner.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1. Liquid Penetrant Inspection: ASTM E 165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates, Bearing Plates and Leveling Plates: Clean concrete-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.

2. Weld plate washers to top of baseplate.
 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

3.3 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified inspector to perform the following special inspections:
1. Verify structural-steel materials and inspect steel frame joint details.
 2. Verify weld materials and inspect welds.
 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

- a. Liquid Penetrant Inspection: ASTM E 165.
- b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
- c. Ultrasonic Inspection: ASTM E 164.
- d. Radiographic Inspection: ASTM E 94.

END OF SECTION 051200

SECTION 05 12 13 - ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING

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: Architecturally exposed structural-steel (AESS) beams, tubes and columns.
 - 1. Requirements in Section 05 12 00 "Structural Steel Framing" also apply to AESS.
- B. Related Sections:
 - 1. Section 09 96 00 "High-Performance Coatings" for high performance coatings on exposed structural steel at exterior locations.

1.3 DEFINITIONS

- A. AESS: Structural steel designated as "architecturally exposed structural steel" or "AESS" in the Contract Documents. AESS shall include exterior exposed steel.

1.4 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication of AESS components. Shop Drawings for structural steel may be used for AESS provided items of AESS are specifically identified and requirements below are met for AESS.
 - 1. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.
 - 2. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation of bolt heads.
- B. Samples: Submit Samples of AESS to set quality standards for exposed welds.
 - 1. Two steel plates, 3/8 by 8 by 4 inches, with long edges joined by a groove weld and with weld ground smooth.
 - 2. Steel plate, 3/8 by 8 by 8 inches, with one end of a short length of rectangular steel tube, 4 by 6 by 3/8 inches, welded to plate with a continuous fillet weld and with weld ground smooth and blended.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Use special care in handling to prevent twisting, warping, nicking, and other damage. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 BOLTS, CONNECTORS, AND ANCHORS

- A. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round-head assemblies, consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Mechanically deposited zinc coating.
- B. Corrosion-Resisting (Weathering Steel), Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 3, round-head assemblies, consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

2.2 FILLER

- A. Filler: Polyester filler intended for use in repairing dents in automobile bodies.

2.3 PRIMER

- A. Primer: Comply with Section 09 96 00 "High-Performance Coatings."

2.4 FABRICATION

- A. In addition to special care used to handle and fabricate AESS, comply with the following:
 - 1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, and roughness.
 - 2. Grind sheared, punched, and flame-cut edges of AESS to provide smooth surfaces and edges.
 - 3. Fabricate AESS with exposed surfaces free of mill marks.
 - 4. Fabricate AESS with exposed surfaces free of seams to maximum extent possible.
 - 5. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

6. Fabricate with piece marks fully hidden in the completed structure or made with media that permits full removal after erection.
 7. Fabricate AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
 8. Seal-weld open ends of hollow structural sections with 3/8-inch closure plates.
- B. Coping, Blocking, and Joint Gaps: Maintain uniform gaps of 1/8 inch with a tolerance of 1/32 inch.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Cleaning Corrosion-Resisting Structural Steel: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- E. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.5 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened in shop and tensioned in the field (twist off type tension indicating bolts).
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work, and comply with the following:
1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding specified tolerances.
 2. Use weld sizes, fabrication sequence, and equipment for AESS that limit distortions to allowable tolerances.
 3. Provide continuous, sealed welds at angle to gusset-plate connections and similar locations where AESS is exposed to weather.
 4. Provide continuous welds of uniform size and profile where AESS is welded.
 5. Grind butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus zero inch.
 6. Remove backing bars or runoff tabs; back-gouge and grind steel smooth.
 7. At locations where welding on the far side of an exposed connection of AESS occurs, grind distortions and marking of the steel to a smooth profile aligned with adjacent material.
 8. Make fillet welds oversize and grind to uniform profile with smooth face and transition.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment.
 - 1. If possible, locate welded tabs for attaching temporary bracing and safety cabling where they will be concealed from view in the completed Work.

3.3 ERECTION

- A. Set AESS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
 - 1. Erect AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
- B. Do not use thermal cutting during erection.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Properly tensioned twist off type tension indicating bolts.
 - 2. Orient bolt heads as indicated on Shop Drawings.
- B. Weld Connections: Comply with requirements in "Weld Connections" Paragraph in "Shop Connections" Article.
 - 1. Remove backing bars or runoff tabs; back-gouge and grind steel smooth.
 - 2. Remove erection bolts, fill holes, and grind smooth.
 - 3. Fill weld access holes and grind smooth.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner shall engage a qualified independent testing and inspecting agency to inspect AESS as specified in Section 05 12 00 "Structural Steel Framing." The testing agency is not responsible for enforcing requirements relating to aesthetic effect.
- B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

3.6 REPAIRS AND PROTECTION

- A. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Grind steel smooth.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 12 13

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SECTION 05 31 00 - STEEL DECKING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General, Supplementary, and Special Conditions and Division 1 Specification Sections, apply to this section.

1.02 SUMMARY:

- A. This Section includes steel deck units for roof and floor applications.

1.03 SUBMITTALS:

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
 1. Product data including manufacturer's specifications and installation instructions for each type of decking and accessories.
 - a. Provide test data for mechanical fasteners used in lieu of welding for fastening deck to supporting structures.
 2. Shop drawings showing layout and types of deck units, anchorage details, and conditions requiring closure strips, supplementary framing, sump pans, cant strips, cut openings, special jointing, and other accessories.
 - a. Shop drawings shall be prepared under the direction of and shall be signed and sealed by, a registered professional engineer licensed in the State of Florida.
 - b. Submit certification, signed and sealed by a registered professional engineer that metal deck design shown on shop drawings complies with loading requirements indicated in this section and on Contract drawings.

1.03 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 (AISI), "Specification for the Design of Cold-Formed Steel Structural Members."
 2. American Welding Society (AWS), D 1.3 "Structural Welding Code - Sheet Steel."
 3. Steel Deck Institute (SDI), "Design Manual for Composite Decks, Form Decks and Roof Decks."
- B. Qualification of Field Welding: Use qualified welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS.

1. Follow Welding Procedures of AWS D1.3/D1.3M for sheet steel and AWS D1.1/D1.1M for stud welding. Submit qualified Welder Qualifications in accordance with AWS D1.3/D1.3M for sheet steel and AWS D1.1/D1.1M for stud welding, or under an equivalent approved qualification test. Perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, perform an immediate retest of two test welds until each test weld passes. Failure in the immediate retest will require the welder be retested after further practice or training, performing a complete set of test welds. Submit manufacturer's catalog data for Welding Equipment and Welding Rods and Accessories.

PART 2 - PRODUCTS

2.01 Manufacturers: Subject to compliance with requirements, provide products of one of the following:

- A. Bowman Metal Deck Div., Cyclops Corp.
Consolidated Systems, Inc.
Epic Metals Corp.
Marlyn Steel Products, Inc.
H. H. Robertson Co.
Roll Form Products, Inc.
Roof Deck, Inc.
United Steel Deck, Inc.
Vulcraft Div., Nucor Corp.
Wheeling Corrugating Co.

2.02 MATERIALS:

- A. Steel for Galvanized Metal Deck Units: ASTM A-653, grade as required to comply with SDI specifications.
- B. Miscellaneous Steel Shapes: ASTM A 36.
- C. Sheet Metal Accessories: ASTM A 526, commercial quality, galvanized.
- D. Galvanizing: ASTM A 525, G60.
 1. Galvanizing Repair: Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A 780.

2.03 FABRICATION:

- A. General: Form deck units in lengths to span three or more supports, with flush, telescoped, or nested 2-inch laps at ends and interlocking or nested side laps, of metal thickness, depth, and width as indicated.
- B. Roof Deck Units: Provide deck configurations that comply with SDI "Specifications and Commentary for Steel Roof Deck." Conform to ASTM A792/A792M or ASTM A1008/A1008M for deck used in conjunction with insulation and built-up roofing. Fabricate roof deck units of 20 gauge design thickness or thicker steel galvanized. Furnish sample Metal Roof Deck Units used to illustrate actual cross section dimensions and configurations.
- C. Composite Deck Units: Conform to ASTM A653/A653M or ASTM A1008/A1008M for composite deck

assembly. Fabricate deck used as the tension reinforcing in composite deck of 0.75 mm 0.0295 inch, as required by design, design thickness or thicker steel with integrally embossed or raised pattern ribs. Shore composite deck until the concrete has reached 75.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. General: Install deck units and accessories in accordance with manufacturer's recommendations, shop drawings, and as specified herein.
1. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.
 2. Align deck units for entire length of nm of cells and with close alignment between cells at ends of abutting units.
 3. Place deck units flat and square, secured to adjacent framing without warp or deflection.
 4. Do not place deck units on concrete supporting structure until concrete has cured and is dry.
- B. Fastening Deck Units:
1. Fasten roof deck units to supporting members in a 36/6 pattern (minimum) for 36" coverage metal deck. Support fasteners shall be as indicated on the structural drawings. Side lap fasteners shall be # 10 TEKS as shown.
 2. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
 3. Use welding washers where recommended by deck manufacturer.
- C. Uplift Loading: Install and anchor roof deck units to resist wind uplift forces in accordance with the ASCE 7-16 for a criteria shown on the Structural Construction Documents.
- D. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking, as shown.
- E. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.
- F. Closure Strips: Provide metal closure strips at open uncovered ends and edges of roof decking and in voids between decking and other construction. Weld into position to provide a complete decking installation.
- G. Touch-Up Painting: After decking installation, wire brush, clean, and paint scarred areas, welds, and rust spots on top and bottom surfaces of decking units and supporting steel members.
1. Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.

2. Touch-up painted surfaces with same type of shop paint used on adjacent surfaces.
3. In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.

END OF SECTION 05 31 00

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior wall and soffit framing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.
- B. Specialty Engineered Shop Drawings:
 - 1. The Contractor shall engage a licensed Engineer to design all light gauge framing and attachments to the structure. This information shall be coordinated with built-in items and structural steel layout.
 - 2. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 3. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product test reports.
- D. Research reports.

1.5 QUALITY ASSURANCE

- A. Product Tests: Mill certificates or data from a qualified independent testing agency.

- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- C. Comply with AISI S230 "Standard for Cold-Formed Steel Framing".

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. ClarkDietrich Building Systems.
 - 2. Nuconsteel, A Nucor Company.
 - 3. United Metal Products, Inc.

2.2 PERFORMANCE REQUIREMENTS

- A. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.3 COLD-FORMED STEEL FRAMING, GENERAL

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Grade: ST50H.
 - 2. Coating: G90.

2.4 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration.

2.5 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, non-staining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multi-monomer plastic, and non-leaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
- B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.2 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
- D. Install framing members in one-piece lengths.
- E. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- F. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- G. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- I. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel 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, which ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 40 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General, Supplementary Conditions, Special Conditions, and technical specification sections, apply to work of this section.

1.2 SUMMARY

A. Section Includes:

1. Miscellaneous steel framing and supports.
2. Shelf angles.
3. Miscellaneous steel trim.
4. Loose bearing and leveling plates.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.3 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- B. Samples for Verification: For each type and finish of extruded nosing and tread.
- C. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design specified structural elements.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 1. Temperature Change: 120 deg F, ambient.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- D. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- F. Stainless Steel Wire Rope: ASTM A 316.
 - 1. Wire-Rope Fittings: Stainless steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- G. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches.
 - 2. Material: Galvanized steel, ASTM A 653/A 653M, with G90 coating
 - 3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, hot-dip galvanized after fabrication.
- H. Aluminum Extrusions: ASTM B 221 , Alloy 6063-T6.
- I. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- J. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- K. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).
- L. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).
- M. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for interior and exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, concealed in walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.
 - 3. Provide stainless-steel fasteners for fastening nickel silver.
 - 4. Provide bronze fasteners for fastening bronze.
- B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

- C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts and nuts.

- D. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting", Section 099123 "Interior Painting", and Section 099600 "High-Performance Coatings."
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- H. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 4000 psi.
- I. Bollards: Provide tight-fitted safety yellow PVC full coverage jackets and domed tops.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
- C. Weld corners and seams continuously to comply 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. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
- E. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 8 inches from ends and corners of units and 24 inches o.c.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls and securely fastened to structure.
- D. Prime shelf angles located in exterior walls with primer specified in Section 099600.
- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
- C. Prime exterior miscellaneous steel trim with primer specified in Section 099600 "High-Performance Coatings."

2.9 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
 - 1. Provide tight-fitted safety yellow PVC full coverage jackets and domed tops.
- B. Fabricate sleeves for bollard anchorage from steel pipe thick steel plate welded to bottom of sleeve.
- C. Prime bollards with primer specified in Section 099600 "High-Performance Coatings."

2.10 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

2.11 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
- B. Galvanize loose steel lintels located in exterior walls, attach to concrete wall as shown on the Structural Construction Documents.
- C. Prime loose steel lintels located in exterior walls with primer specified in Section 099600 "High-Performance Coatings."

2.12 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.13 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.

2.14 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with primers specified in Section 099600 "High-Performance Coatings".
- C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
- B. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete in formed or core-drilled holes. Fill annular space around bollard solidly with nonshrink grout.
- C. Fill bollards solidly with concrete, mounding top surface to shed water.
- D. Install tight-fitted safety yellow PVC jackets and tops.

3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 50 00

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SECTION 05 51 00 - METAL STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary and Special Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. The Contractor shall engage a Specialty Engineer to provide a complete stair design, including connections to the structure. This Section includes the following:
 - 1. Preassembled steel stairs with concrete-filled pan treads.
 - 2. Steel tube railings attached to metal stairs.
 - 3. Steel tube handrails attached to walls adjacent to metal stairs.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for concrete fill for stair treads, landings and platforms.
 - 2. Division 05 Section Pipe & Tube Railings for fabrication requirements of all railing and handrail systems.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 150 lbf/sq. ft.
 - 2. Concentrated Load: 350 lbf applied on an area of 4 sq. in.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to $L/360$ or $3/16$ inch, whichever is less.
- B. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails:
 - a. Uniform load of 150 lbf/ ft. applied in any direction.
 - b. Concentrated load of 250 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Top Rails of Guards:

- a. Uniform load of 150 lbf/ ft. applied in any direction.
 - b. Concentrated load of 250 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
3. Infill of Guards:
- a. Concentrated load of 150 lbf applied horizontally on an area of 1 sq. ft. .

1.4 SUBMITTALS

- A. Product Data: For metal stairs and the following:
 1. Paint products.
 2. Grout.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 1. Provide templates for anchors and bolts specified for installation under other Sections.
 2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design.
- D. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
 1. Preassembled Stairs: Commercial class.
- C. Welding: Qualify procedures and personnel according to the following:
 1. AWS D1.1, "Structural Welding Code--Steel."
 2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.6 COORDINATION

- A. Coordinate installation of anchorages for metal stairs. 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.
- B. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated (See Architectural Drawings). For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes. All exterior steel shall be hot dip galvanized prior to installation, or provide TNEMEC coating system.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: [ASTM A 500 (cold formed)] [or] [ASTM A 513, Type 5 (mandrel drawn)].
- C. Iron Castings: Either gray or malleable iron, unless otherwise indicated.
 - 1. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
 - 2. Malleable Iron: ASTM A 47/A 47M.
- D. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coating, structural steel, Grade 33, unless another grade is required by design loads.

2.3 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts and washers complying with ASTM F 594.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- E. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding, unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
 - 3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.
 - 4. Visible unsightly welds may be required to be repaired or replaced at the discretion of the Architect.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch , unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- F. Weld connections to comply 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. Weld exposed corners and seams continuously, unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.
- H. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.6 STEEL-FRAMED STAIRS

- A. Stair Framing:
 - 1. Fabricate stringers of steel tubes as indicated.
 - a. Provide closures for exposed ends of tube stringers.
 - 2. Construct platforms of steel tube headers and miscellaneous framing members as needed to comply with performance requirements.
 - 3. Weld stringers to headers; weld framing members to stringers and headers.
 - 4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- B. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.0677 inch.
1. Steel Sheet: Galvanized steel sheet.
 2. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
 3. Shape metal pans to include nosing integral with riser.
 4. At Contractor's option, provide stair assemblies with metal-pan subtreads filled with reinforced concrete during fabrication.
 5. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.
 - a. Smooth Soffit Construction.

2.7 STAIR RAILINGS

- A. Comply with applicable requirements in Division 05 Section "Pipe and Tube Railings" for railings, and as follows:
1. Fabricate newels of steel tubing and provide newel caps of steel.
 2. Connect posts to stair framing by direct welding.

2.8 FINISHES

- A. Finish metal stairs after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
 3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. Provide Dry-Fall (Powder Coat) final finish as specified in Section 09 91 23 – Interior Painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.

- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Field Welding: Comply with the following requirements:
 - 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- G. Place and finish concrete fill for treads and platforms to comply with Division 03 Section "Cast-in-Place Concrete."

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of baseplates.
- B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonmetallic, nonshrink grout, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING STEEL TUBE RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
 - 1. Anchor posts to steel by welding directly to steel supporting members.
 - 2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.
- B. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

3.4 ADJUSTING AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
- B. Touch-Up paint any abrasions resulting from the installation process.

END OF SECTION 05 51 00

SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

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:
 - 1. Wood blocking and nailers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated wood.
 - 2. Power-driven fasteners.

1.5 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use or similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 - RODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - 1. Preservative chemicals shall be acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Application: Treat items indicated on Drawings, and the following:
 - 1. Items in contact with concrete or masonry.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
- B. Screws for Fastening to Metal Framing: ASTM C 954, length as recommended by screw manufacturer for material being fastened.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F836M, Grade A1 or A2).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.
- B. Comply with manufacturer's requirements for cutting, handling, fastening, and working treated materials.

- C. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- D. Restore damaged components. Protect work from damage.
- E. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.10.1, "Fastening Schedule," in the Florida Building Code.
 - 2. ICC-ES evaluation report for fastener.

END OF SECTION 06 10 53

SECTION 06 40 20 - INTERIOR ARCHITECTURAL MILLWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 1. Wood cabinetry
 2. Plastic laminate cabinetry
 3. Stone and solid surface countertops
 4. Plastic laminate countertops
 5. Shop or field finishing interior cabinetry
 6. Cabinet hardware
 7. Preparation for installing utilities
- B. Related Sections include the following:
 1. Division 6 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
 2. Division 8 Section "Wood Doors."
 3. Division 9 Section "Painting" for field finishing of interior architectural woodwork.

1.3 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.

1.4 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) – Architectural Woodwork Standards; 2014.
- B. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.
- C. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- D. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.4 SUBMITTALS

- A. See Section 01 30 00 Administrative Requirements for Submittal Procedures
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Include materials, component profiles, fastening methods, jointing details
 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, grommets and other items installed in architectural woodwork.
- C. Samples: Submit actual samples of architectural cabinet finishes, minimum 4"x4" square, illustrating proposed cabinet, countertop and shelf unit finishes.
1. Shop-applied opaque finishes.
- D. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- E. Product Data: Provide data for hardware accessories.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed architectural woodwork similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Fabricator Qualifications: A firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.
1. Provide AWI Quality Certification Program certificate indicating that woodwork complies with requirements of grades specified.
- D. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production and installation of all interior architectural woodwork.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.
- B. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is 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. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.
 - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.
- B. Before fabrication of millwork contractor shall field verify dimensions of the constructed room in which millwork is scheduled to be provided. For example, but not limited to, the location of installed doors shall be field verified to determine the fit of the shelving in the constructed room, such as directly behind the doors.
- C. All millwork shall be provided per all the finishes as noted in the drawings and finish legend. All millwork shall be provided per all the sizes, configurations, and dimensions as both illustrated, dimensioned, and noted in the drawings. All millwork shall be provided per all the fabrication details both illustrated and noted in the drawing sheets.
- D. Hardware Coordination: Distribute copies of approved hardware schedule specified in Division 8 Section "Door Hardware Scheduled by Naming Products" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 WOODWORK FABRICATORS – N/A

2.2 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Species for Opaque Finish: Any closed-grain hardwood.

- C. Wood Products: Comply with the following:
 1. Hardboard: AHA A135.4.
 2. Medium-Density Fiberboard: ANSI A208.2, Grade MD-Exterior Glue.
 3. Softwood Plywood: DOC PS 1, Medium Density Overlay.
 4. Hardwood Plywood and Face Veneers: HPVA HP-1.

- D. Plastic Laminate Faced Cabinets: Custom grade:
 1. Finish - Exposed Exterior Surfaces: Decorative laminate.
 2. Finish - Exposed Interior Surfaces: Decorative laminate.
 3. Finish - Concealed Surfaces: Decorative laminate.
 4. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
 5. Door and Drawer Front Retention Profiles: Fixed panel.
 6. Casework Construction Type: Type A - Frameless.
 7. Adjustable Shelf Loading: 50 lbs. per sq. ft.
 8. Cabinet Style: Flush overlay.
 9. Cabinet Doors and Drawer Fronts: Flush style.
 10. Drawer Side Construction: Rabbeted.
 11. Drawer Construction Technique: Lock shoulder joints.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Door Hardware (Scheduled by Naming Products.)"
- B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.
- C. Adhesive: Type recommended by fabricator to suit application.
- D. Plastic Edge Banding (for Plastic Laminate Faced Cabinets): Extruded PVC, flat shaped; smooth finish; 1 mm thick maximum; of width to match component thickness.
 1. Color: To match adjacent surface.
 2. Use at all exposed shelf edges.
 3. Use at exposed countertop edges.
 4. Use at Doors and Drawer Fronts.
- E. Fasteners: Size and type to suit application. Concealed - No exposed fasteners.
- F. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- G. Concealed Joint Fasteners: Threaded steel.
- H. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface
- I. Hinges: European style concealed self-closing type, 110-degree minimum opening steel with polished finish. Minimum 2 per door.

1. Manufacturers:
 - a. Basis or Requirement: Grass America Inc; Tiomos Soft-Close: www.grassusa.com.
 - b. Other Acceptable Manufacturers:
 - 1) Hardware Resources: www.hardwareresources.com.
 - 2) Hettich America, LP: www.hettichamerica.com.
 - 3) Julius Blum, Inc: www.blum.com.

- J. Countertop Supports: Steel Bracket equal to Rakks EH-1824 Bracket, with minimum 450# weight capacity, in epoxy coat finish as selected, sizes as shown on the Drawings.

- K. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
 1. Product: 1 3/4" Cylinder Lock manufactured by Rockler.

- L. Typical Base and Wall Cabinet Pulls – Equal to:
 1. <https://www.richelieu.com/us/en/category/decorative-hardware/cabinet-hardware-pulls-and-knobs/pulls/contemporary-stainless-steel-pull-305/1200201/sku-BP30576170>
 2. 3" Center to Center Contemporary Steel Bar Pull
 3. Richelieu Model # BP30576170
 4. Finish: Brushed Nickel

- M. Catches: Magnetic Catches, BHMA A156.9, B03141.

- N. Adjustable Shelf Standards and Supports: Standard drilled side panels with 4-pin supports at each shelf.

- O. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, and rated for the following loads. Static Load Capacity: Heavy Duty Grade.
 1. Box Drawer Slides: 75lbf (330 N).
 2. File Drawer Slides: 150lbf (670 N).

- P. Grommets for Cable Passage through Countertops: 2-inch (51-mm) OD, molded-plastic grommets and matching plastic caps with slot for wire passage. Color to be selected by Architect.

- Q. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 1. See Drawings

- R. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

- B. Delete paragraph above or below, or both, if included in a carpentry section.
- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.5 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide Custom grade interior woodwork complying with the referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: **1/16 inch (1.5 mm)**.
- D. Complete fabrication, including assembly, finishing and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- E. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 1. Seal edges of openings in countertops with a coat of varnish.

2.6 SOLID-SURFACE-MOUNTING COUNTERTOPS

- A. Products and selections as indicated on plans in the finish index. Corian solid surface countertop and Duracon epoxy resin lab countertop.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of **1/8 inch in 96 inches (3 mm in 2400 mm)**.
- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails [or finishing screws] for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- E. Cabinets: Install without distortion so 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 installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than **1/8 inch in 96-inch (3 mm in 2400-mm)** sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, at ends and not more than **16 inches (400 mm)** o.c. with No. 10 wafer-head screws sized for **1-inch (25-mm)** penetration into wood framing, blocking, or hanging strips.
- F. Countertops: Anchor securely at all perimeter framing and corner blocks of base cabinets or other supports at underside of countertop.
 - 1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - 2. Install countertops with no more than **1/8 inch in 96-inch (3 mm in 2400-mm)** sag, bow, or other variation from a straight line.
 - 3. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
 - 4. Caulk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."
- G. Complete the finishing work specified in this Section to extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in shop.
- H. Refer to Division 9 Sections for final finishing of installed architectural woodwork.

3.3 ADJUSTING AND CLEANING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.
- C. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- D. Clean, lubricate, and adjust hardware.
- E. Clean woodwork on exposed and semi exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 40 20

SECTION 07 21 00 - THERMAL INSULATION

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:
 - 1. Glass-fiber blanket insulation
 - 2. Sound attenuation batt insulation
 - 3. Foil faced polyisocyanurate rigid insulation

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

- A. Glass-Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. 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:
 - a) CertainTeed Corporation.
 - b) Johns Manville; a Berkshire Hathaway company.
 - c) Owens Corning.

2.2 SOUND ATTENUATION BATT INSULATION BATTS

- A. Mineral-fiber unfaced sound attenuation batts or blankets for tight friction fit between framing members, meeting requirements of ASTM C 553 or ASTM C 665, as applicable.
 - 1. 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:

- a) CertainTeed Corporation.
- b) Johns Manville; a Berkshire Hathaway company.
- c) Owens Corning.

2.3 POLYISOCYANURATE FOAM PLASTIC BOARD

- A. Foil Faced: ASTM C 1289, foil faced, Type I, Class 1 or 2.
 - 1. 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:
 - a) CertainTeed Corporation.
 - b) Johns Manville; a Berkshire Hathaway company.
 - c) Owens Corning.

2.4 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 - 1. Glass Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame spread and smoke developed indexes of 5, per ASTM E 84.
- B. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.
- C. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.2 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- B. Acoustical Insulation: Install tightly in cavities formed by framing members, with no voids of insulation, and according to the following requirements:
1. Provide adhesive, tape or other appropriate fasteners where required to hold insulation tightly in place.
 2. Openings and penetrations in acoustical walls and partitions shall be sealed airtight.

END OF SECTION 07 21 00

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SECTION 07 25 00 – WEATHER BARRIERS

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:
 - 1. Building wrap.
 - 2. Flexible flashing
 - 3. Drainage material

1.3 SUBMITTALS

- A. Product Data: Provide data indicating material characteristics, performance criteria, and limitations.
- B. Manufacturer's Installation Instructions: Indicate preparation and installation requirements, and techniques.

PART 2 – PRODUCTS

2.1 WATER RESISTIVE BARRIER

- A. Building Wrap: ASTM E1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E84; UV stabilized. Tyvek CommercialWrap by DuPont Corporation, or approved equal.
- B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 FLEXIBLE FLASHING

- A. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.030 inch (0.8 mm). DuPont DuraGuard CM or approved equal.

2.3 DRAINAGE MATERIAL

- A. Drainage Material: Product shall maintain a continuous open space between water-resistive barrier and exterior cladding to create a drainage plane and shall be used under siding. Tyvek DrainVent rainscreen or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify condition of substrate and adjacent materials are ready to receive work prior to installation..

3.2 PREPARATION

- A. Remove loose or foreign matter which might impair installation.

3.3 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.

END OF SECTION 07 25 00

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SECTION 07 46 46 – FIBER CEMENT SIDING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiber cement siding and trim.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for each type of product.
- C. Samples: For each type of siding and trim 8" long by sample width illustrating finish, and texture.
- D. Product Certificates
- E. Maintenance Data
- F. Sample Warranty: 25 years from the date of substantial completion.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.05 MOCKUPS

- A. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

PART 2 PRODUCTS

2.01 FIBER CEMENT SIDING

- A. General: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested in accordance with ASTM E136; with a flame-spread index of 25 or less when tested in accordance with ASTM E84.
 - 1. Manufacturer: James Hardie Products or approved equal.
- B. Labeling: Provide fiber-cement siding that is tested and labeled in accordance with ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.
- C. Nominal Thickness: Not less than 5/16"
- D. Horizontal Pattern:
 - 1. Boards 7.25 inches for a 6" reveal.

2. Boards Artisan shiplap 10.25 inches for a 9" reveal.
- E. Trim boards:
1. Primed for Paint – ¾ inch thickness 3.5 inch width for 1.75" trim.
 2. Primed for Paint – 1 inch thickness 11.25 inch width.

2.02 ACCESSORIES

- A. Siding Accessories, General: Provide starter strips, edge trim outside and inside corner caps and other items as recommended by siding manufacturer for building configuration.
- B. Flashing: Provide flashing complying with section 07 62 00 Sheet Metal Flashing and Trim and as indicated in the Drawings.
- C. Fasteners:
 1. For fastening to wood, use siding nails of sufficient length to penetrate a minimum of 1 inch into substrate.
 2. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch into substrate.
 3. For fastening into fiber cement, use hot dipped galvanized fasteners.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply. Install fasteners no more than 24 inches o.c.
- B. Install joint sealants as specified in Section 07 92 00 Joint Sealants, and to produce a weathertight installation
- C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at a rate greater than 1/16 inch/ft.

3.02 ADJUSTING AND CLEANING

- A. Remove damage, improperly installed, or otherwise defective materials and replace with new materials complying with the specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION

SECTION 07 54 23 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

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:

1. Adhered thermoplastic polyolefin (TPO) roofing system.
2. Roof insulation.
3. Roof cover board.
4. Sheet flashings.
5. Roof hatch.

B. Related Requirements:

1. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashings and counter flashings.
2. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.3 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Roof plan showing layout and thickness of insulation.
2. Base flashings and membrane terminations.
3. Flashing details at penetrations.
4. Tapered insulation thickness and slopes.
5. Insulation adhesive patterns for corner, perimeter, and field-of-roof locations.
6. Expansion joint locations.

- C. Samples: For the following products:
 - 1. Roof membrane and flashing, of color required.
- D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and Manufacturer.
 - 1. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
 - 2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- B. Product Test Reports: For roof membrane and insulation, tests performed by independent qualified testing agency indicating compliance with specified requirements.
- C. Research/ Evaluation Reports: Evidence of acceptance of roof assemblies by Miami- Dade County Building and Neighborhood Compliance Department or evidence of compliance with performance requirements as tested by entities listed with the Florida Building Code Commission.
- D. Field quality-control reports.
- E. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
- B. Source Limitations: Obtain components including roof insulation, cover board, adhesives, for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled

with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories, and other components of roofing system.
 - 2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
- B. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D 3746, ASTM D 4272/D 4272M.
- C. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

- D. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to latest edition of ASCE 7-10.
 - 1. Design wind velocity and Risk Category shall be as indicated on structural drawings.
 - 2. Design pressures for components and cladding shall be as indicated on structural drawings.
- E. Hurricane-Resistance Test Performance: Provide roofing systems that pass testing requirements of authorities having jurisdiction.
 - 1. Comply with the Florida Building Code, 2020 Edition.
 - 2. Provide roof assemblies accepted by Miami-Dade County Building and Neighborhood Compliance Department or complying with performance requirements as tested by entities listed with the Florida Building Code Commission.
- F. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.83 and an emissivity of not less than 0.90 when tested according to CRRC-1.
- G. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- H. Roofing surface shall meet Florida Energy Code Reflectance Factor requirements applicable to roof slope.

2.2 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

- A. TPO Sheet: ASTM D6878/D6878M, internally fabric- or scrim-reinforced TPO sheet.
 - 1. Available manufacturers offering products that may be incorporated into the Work include, but are not limited to:
 - a. Carlisle Syn Tech, Inc.
 - b. Firestone
 - c. GAF
 - d. Johns Manville; a Berkshire Hathaway Company
 - e. Sika Sarnafil
 - 2. Thickness: 60 mils minimum, and as required to meet wind loads indicated on the drawings.
 - 3. Exposed Face Color: White.

2.3 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: Manufacturer's standard prefinished metal flashing of same material, type, reinforcement, thickness, and color as TPO sheet.
- C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
- D. Bonding Adhesive: Manufacturer's standard recommended for specific application.
- E. Low-Rise, Urethane, Fabric-Backed Membrane Adhesive: Roof system manufacturer's standard spray-applied, low-rise, two-component urethane adhesive formulated for compatibility and use with fabric-backed membrane roofing.
- F. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in ASTM B 117, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.
- H. Expansion Joints: Manufacturer's standard, pre-molded expansion joint covers for roof-to-roof and roof-to-wall transitions, designed for heat welding to roof and wall flashing membranes. Furnish complete with all accessories, including compressible foam rods.
- I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.
- J. Roof Hatch: Provide manufacturer's standard 24 x 36 roof access hatch complete with all curbs and flashings for a complete installation.

2.4 COVER BOARDS

- A. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate or ASTM C 1278/C 1278M, fiber-reinforced gypsum board.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corporation; GlasRoc Roof Board.
 - b. Georgia-Pacific Building Products; Dens Deck/Dens Deck Prime.
 - c. National Gypsum Company; DEXcell FA Glass Mat Roof Board.
 - d. United States Gypsum Company; Securock Glass Mat Roof Board.
 2. Thickness: 1/2 inch
 3. Surface Finish: Unprimed.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions ASTM B 117, designed for fastening substrate board to roof deck.

2.5 ROOF INSULATION

- A. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
 - 1. 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:
 - a. Atlas Roofing Corporation.
 - b. Carlisle SynTec Incorporated.
 - c. Firestone Building Products.
 - d. GAF Materials Corporation.
 - e. Johns Manville; a Berkshire Hathaway company.
 - 2. Size: 48 by 48 inches.
 - 3. Thickness:
 - a. Base Layer: Maximum 2 inches.
 - b. Upper Layer: As required to achieve R-Values indicated on the drawings.
- B. Tapered Insulation: Provide factory-tapered insulation boards.
 - 1. Material: Match roof insulation.
 - 2. Minimum Thickness: 1/4 inch.
 - 3. Slope:
 - a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

2.6 INSULATION ACCESSORIES

- A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in ASTM B 117, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
 - 1. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
 - 2. Full-spread, spray-applied, low-rise, two-component urethane adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that surface plane flatness complies with manufacturer's recommendations.
- B. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- C. Prevent materials from spilling or migrating onto surfaces of other construction.

3.2 PREPARATION

- A. Perform adhesive-pullout tests according to roof system manufacturer's written instructions.
 1. Submit test result within 24 hours after performing tests.
 - a. Include manufacturer's requirements for any revision to previously submitted adhesive patterns required to achieve specified wind uplift requirements.

3.3 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions, to meet wind pressures indicated on the drawings.
 1. Install roofing accessories, including factory primed edge flashings, pipe boots and expansion joints, per manufacturer's written instructions.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.4 INSULATION INSTALLATION

- A. Coordinate installing roofing system components, so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Installation Over Concrete Plank Decking:
 1. Adhere insulation to substrate using adhesive according to manufacturer's recommendations to resist wind uplift pressures indicated on the drawings.
 - a. Adhere insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
 2. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows.

- a. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 - d. Fill gaps exceeding 1/4 inch with insulation.
 - e. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
3. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
- a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 - e. Fill gaps exceeding 1/4 inch with insulation.
 - f. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

3.5 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
 - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 2. Cut and fit cover board tight to nailers, projections, and penetrations.
 - 3. Adhere cover board to insulation substrate using adhesive according to membrane roofing system manufacturer's written instructions to resist specified uplift pressure at corners, perimeter, and field of roof, as indicated on the structural drawings.

3.6 INSTALLATION OF ADHERED ROOFING INSTALLATION

- A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll roof membrane and allow to relax before installing.
- C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- D. Accurately align roof membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

- E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.
- F. Fabric-Backed Roof Membrane Adhesive: Apply to substrate at rate required by manufacturer and install fabric-backed roof membrane.
- G. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.
- H. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- I. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
 - 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

3.7 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor shall provide a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

- C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.8 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 54 23

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

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:

1. Formed roof-drainage sheet metal fabrications.
2. Formed low-slope roof sheet metal fabrications.
3. Formed wall sheet metal fabrications.

B. Related Sections:

1. Section 07 92 00 "Joint Sealants" for field-applied sealants between flashings and adjacent materials.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site, to ensure coordination with siding installations, and with manufactured specialty items,

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints, direction of expansion, roof-penetration flashing, and connections to adjoining work.

- C. Samples: For each exposed product and for each color and texture specified.

1. 8-inch square samples of specified sheet materials to be exposed as finished surfaces. Provide complete with specified factory finish.

- D. Sample warranty.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.5 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install copings and flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:
 1. Design Pressure: As indicated on the structural drawings.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209 , alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 1. As-Milled Finish: Mill.
 2. Exposed Coil-Coated Finish:

- a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Color: As selected by Architect from manufacturer's full range to match adjacent wall colors.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; 2B (bright, cold rolled).
- D. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; pre-painted by coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Color: As selected by Architect from manufacturer's full range to match adjacent wall colors.

2.3 UNDERLAYMENT MATERIALS

- A. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F; and complying with physical requirements of ASTM D 226/D 226M for Type I and Type II felts.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 4. Fasteners for Zinc-Coated (Galvanized) and Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane, polysulfide or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
1. Obtain field measurements for accurate fit before shop fabrication.
 2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal. Fabricate to sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- E. Seams: At visible locations in running lengths of sheetmetal trim, fabricate nonmoving seams with flat-lock seams or standing seams and concealed cleats. Form seams and seal with elastomeric sealant or epoxy seam sealer, unless otherwise recommended by sealant manufacturer for intended use.

1. Nonvisible seam locations may utilize lap seams with sealant or seam sealer.

F. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Gutters: Fabricated or prefinished, manufactured components as follows:

1. Gutters: Fabricated from prefinished minimum 0.032 inch thick aluminum. Fabricate to box profile indicated on the drawings.
2. Gutter Brackets and Straps: Fabricated from prefinished, heavy gage aluminum bar stock, to configurations shown on the drawings.
3. Finish: Two-Coat Fluoropolymer; AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight. Provide on all gutter and downspout components.
 - a. Color: As selected by Architect from manufacturer's full range of colors.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated.

4. Downspouts: Fabricated from prefinished 0.032 inch thick aluminum with continuous flat lock seam. Fabricate to profile indicated on the drawings and with mitered elbows.
5. Downspout Straps: Fabricated from prefinished, heavy gage aluminum bar stock, to configurations shown on the drawings.
6. Finish: Two-Coat Fluoropolymer; AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight. Provide on all gutter and downspout components.
 - a. Color: As selected by Architect from manufacturer's full range of colors to match adjacent wall color.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Copings: Fabricate in minimum 96-inch- long, but not exceeding 12-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners. Fabricate from the Following Materials:

1. Aluminum: 0.050 inch thick.
2. Galvanized Steel: 0.040 inch Thick.
3. Aluminum-Zinc Alloy-Coated Steel: 0.040 inch thick.

B. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Aluminum: 0.040 inch thick.
2. Galvanized Steel: 0.028 inch Thick.
3. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

C. Counterflashing and Flashing Receivers: Fabricate from the following materials:

1. Aluminum: 0.032inch thick.
2. Galvanized Steel: 0.022 inch Thick.
3. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

2.8 WALL SHEET METAL FABRICATIONS

- A Miscellaneous Wall Flashings: Fabricate flashings to configurations shown on the drawings. Fabricate from the following materials:

1. Aluminum: 0.032inch thick.
2. Galvanized Steel: 0.022 inch Thick.
3. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

- A. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, according to manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Install sheet metal flashing and trim in accordance with SMACNA's "Architectural Sheet Metal Manual" requirements, including recommended dimensions for laps and roof- to-wall transitions.
 2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
 3. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 4. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 5. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 6. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

3.3 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

- A. General: Install components to produce a complete roof-edge drainage system, including scuppers, conductors, and downspouts indicated on the drawings.
- B. Gutters: Join sections with joints lapped and sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia securely to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.
- B. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at maximum 4'-0" on center.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.

- D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches.

3.5 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated.

- 1. Configuration of wall flashings shall be as indicated on the drawings.

3.6 CLEANING AND PROTECTION

- A. Clean off excess sealants and clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 07 62 00

SECTION 07 84 13 - PENETRATION FIRESTOPPING

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:
 - 1. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in smoke barriers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
 - 1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.5 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
 - 1. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. Grace Construction Products.
 - 2. Hilti, Inc.
 - 3. Johns Manville.
 - 4. Tremco, Inc.; Tremco Fire Protection Systems Group.
 - 5. USG Corporation.

2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
 - 1. Fire-resistance-rated walls include smoke-barrier walls and fire partitions.
- B. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
- C. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

- A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 84 13

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SECTION 07 92 00 - JOINT SEALANTS

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:
 - 1. Non-staining silicone joint sealants.
 - 2. Urethane joint sealants.
 - 3. Mildew-resistant joint sealants.
 - 4. Latex joint sealants.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product data.
- B. Samples: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-sealant schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Field-adhesion-test reports.
- C. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Warranty Documentation:
 - 1. Manufacturers' special warranties.
 - 2. Installer's special warranties.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

1.8 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

2.3 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
- B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.
- C. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T and NT.

2.4 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

2.5 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

2.6 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include, but not limited to, the following:
 - a. Concrete.
 - b. Masonry.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include, but not limited to, the following:
 - a. Metal.
 - b. Glass.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.
- G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.
- H. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.3 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 5 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
 - 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.4 JOINT-SEALANT SCHEDULE

- A. Contractor shall develop a comprehensive joint sealant schedule for submittal, review and approval by Architect. Schedule shall clearly identify joint locations, sealant type and color. (Note that sealant color shall, in general, match color of adjacent surfaces to be sealed).

END OF SECTION 07 92 00

SECTION 08 11 13 - STANDARD STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Non-rated steel doors.
- B. Non-rated steel frames.

1.2 RELATED SECTIONS

- A. Section 08 14 16 - Flush Wood Doors.
- C. Section 09 91 14 - Exterior Painting

1.3 REFERENCES

- A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
- B. ANSI/SDI-100 - Standard Steel Doors and Frames.
- C. ASTM A525 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- D. DHI - Door Hardware Institute: The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate frame elevations, reinforcement, and finish.
- B. Product Data: Indicate frame configuration, anchor types and spacings, location of cut-outs for hardware, reinforcement.
- C. Manufacturer's Installation Instructions: Indicate special installation instructions.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Conform to requirements of ANSI/SDI-100 and ANSI A117.1
- B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Accept frames on site in manufacturer's packaging. Inspect for damage.

1.8 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

1.9 COORDINATION

- A. Coordinate the work with frame opening construction, door and hardware installation.

PART 2 PRODUCTS

2.1 DOOR MANUFACTURERS

- A. Amweld Building Products
- B. Ceco Corporation
- C. Curries Manufacturing

2.2 DOORS

- A. Doors shall be raised panel construction, fabricated from cold rolled steel, 16 gauge for exterior and 18 gauge for interior. Doors shall be reinforced, stiffened and insulated with impregnated kraft honeycomb or polystyrene foam core permanently bonded to the inside of each face skin. Both lock and hinge rail edge of the door shall be welded, filled and ground smooth the full height of the door or both lock and hinge rail edge may have an exposed hairline seam. Doors shall have beveled (1/8" in 2") hinge and lock edges. Top and bottom steel reinforcement channels shall be 14 gage and spot welded within the doors. Hinge reinforcements shall be 8 gauge for 1-3/4 doors. Lock reinforcements shall be 16 gage and closer reinforcements. Fabricate doors and transoms with hardware reinforcement welded in place.
- B. Primer: Baked on coat of rust inhibitive primer.
- C. Field painted by General Contractor.

2.3 FRAME MANUFACTURERS

- A. Amweld Building Products
- B. Steelcraft - Cincinnati, Ohio
- C. Curries Manufacturing - Mason City, Iowa
- D. Mesker Door, Inc.

- E. Republic Steel
- F. Allied Steel Products
- G. D&D Specialties, Inc.

2.4 FRAMES

- A. Frames: To suit ANSI/SDI-100 Grade and Model of door specified in Section 08111 and Section 08211.
- B. Exterior Frames: 14 gauge thick material, base metal thickness.
- C. Interior Frames: 16 gauge thick material, base metal thickness.

2.5 ACCESSORIES

- A. Silencers: Resilient rubber, fitted into drilled hole, 3 per frame or as listed at 2.4 D
- B. Removable Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamper proof screws.

2.6 FABRICATION

- A. Fabricate frames as welded unit.
- B. Transom Bars for Glazed Lights: Fixed type, of same profiles as jamb and head.
- C. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes.
- D. Prepare frame for silencers. Provide three single silencers for single doors on strike side. Provide two single silencers on frame head at double doors without mullions.

2.7 FINISH

- A. Primer; Baked on coat of rust inhibitive primer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that opening sizes and tolerances are acceptable.

3.2 INSTALLATION

- A. Install frames in accordance with ANSI/SDI-100 and DHI.
- B. Coordinate with masonry, wallboard and existing wall construction for anchor placement.
- C. Coordinate installation of frames with installation of doors, and door hardware.
- D. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.
- E. Coordinate installation of glass and glazing.
- F. Coordinate installation of doors with installation of frames and hardware as supplied

3.3 ERECTION TOLERANCES

- A. Maximum Diagonal Distortion:
 - 1. Frame: 1/8 inch measured with straight edges, crossed corner to corner.
 - 2. Door: 1/16 inch measured with straight edge corner to corner.

3.4 ADJUSTING

- A. Adjust door for smooth and balanced door movement.

END OF SECTION 08 11 13

SECTION 08 141 6 - FLUSH WOOD DOORS

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:
 1. Five-ply flush wood veneer-faced doors for transparent finish.
 2. Factory finishing flush wood doors.
 3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including the following:
 1. Door core materials and construction.
 2. Door edge construction
 3. Door face type and characteristics.
 4. Door trim for openings.
 5. Factory-machining criteria.
 6. Factory finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
 1. Door schedule indicating door location, type, size, and swing.
 2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
 3. Dimensions and locations of blocking for hardware attachment.
 4. Clearances and undercuts.
 5. Requirements for veneer matching.
- C. Samples: For factory-finished doors.

PART 2 - PRODUCTS

2.1 FLUSH WOOD DOORS GENERAL

- A. Quality Standard: In addition to requirements specified, comply with "Architectural Woodwork Standards."
 1. Provide labels and certificates indicating that doors comply with requirements of grades specified.

2.2 SOLID-CORE, FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors, Solid-Core Five-Ply Veneer-Faced:

1. 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:
 - a. VT Industries.
 - b. Marshfield Door Systems.
 - c. Eggers Industries
 - d. Lambton
 - e. Algoma
2. Performance Grade: Heavy Duty.
3. Architectural Woodwork Standards Grade: Custom.
4. Faces: Single-ply wood veneer not less than 1/50 inch thick.
 - a. Species: Select white birch.
 - b. Cut: Plain sliced (flat sliced).
 - c. Match between Veneer Leaves: Book match.
 - d. Assembly of Veneer Leaves on Door Faces: Running match.
5. Exposed Vertical Edges: Applied wood-veneer edges of same species as faces and covering edges of faces - Architectural Woodwork Standards edge Type B.
6. Core for Non-Fire Rated Doors:
 - a. ANSI A208.1, Grade LD-1 particleboard.
 - 1) Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware and as follows:
 - a) 5-inch top-rail blocking, in doors indicated to have closers.
 - b) 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - c) 5-inch midrail blocking, in doors indicated to have exit devices.
7. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
 - a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.
8. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.3 LIGHT FRAMES AND LOUVERS

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
 - 1. Wood Species: Same species as door faces.
 - 2. Profile: Manufacturer's standard shape.
- B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated on Drawings. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.4 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.
 - 1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
- B. Factory machine doors for hardware that is not surface applied.
 - 1. Locate hardware to comply with DHI-WDHS-3.
 - 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
 - 3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
- C. Openings: Factory cut and trim openings through doors.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."

2.5 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing.
 - 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 2. Finish faces, all four edges, edges of cutouts, and mortises.
 - 3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors to receive transparent finish with manufacturer's standard transparent finish system.
 - 1. Color: As selected by Architect from Manufacturer's full range of colors.

2. Sheen: Satin.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Hardware: For installation, see Section 08 71 00 "Door Hardware."
- B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Install frames level, plumb, true, and straight.
 1. Install fire-rated doors and frames in accordance with NFPA 80.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.2 FIELD QUALITY CONTROL

- A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 3 13 – OVERHEAD SECTIONAL DOORS

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:
 - 1. Glass sectional overhead doors.

1.3 REFERENCES

- A. ANSI A216.1 - Sectional Overhead Type Door (NAGDM 1020).
- B. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- C. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- D. ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

1.4 SYSTEM DESCRIPTION

- A. Stile and rail sectional aluminum door with glass panels.
- B. Standard lift operating style with track and hardware.
- C. Operation: Manual.
- D. Design and size components to withstand dead and live loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with code to a design pressure as measured in accordance the ANSI/ASTM E330.

1.5 SUBMITTALS

- B. Product Data: For each type and size of coiling counter door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, and finishes.

- C. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Show locations of controls, locking devices, and other accessories.
- D. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Include data for lubrication frequency, spare part sources, etc.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ANSI S216.1, Application Type Industrial.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing the work of this section with minimum three years documented experience or approved by manufacturer.

1.8 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for motor and motor control requirements.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

1.9 WARRANTY

- A. Provide five year manufacturer's warranty.

1.10 PERFORMANCE

- A. Requirements-Wind loading as per FBC-B

PART 2 - PRODUCTS

2.1 GLASS SECTIONAL DOORS

- A. Raynor Garage Doors: AlumaView Optima (HL). Normal, high lift head room installation.

- B. Other acceptable manufacturers.
 - 1. Overhead Door Company.
 - 2. Windsor Door.
 - 3. Arm-R-Lite.

- C. Door Sections: Sections shall be 2" (50.8mm) thick, aluminum extrusions produced from 6063-T6 alloy. Rails and stiles shall provide a weathertight closure and assure alignment of the full width of each section. Stiles and rails shall be miter-cut and securely joined. Minimum stile and rail dimensions shall be as per manufacturer's standard.

- D. Tracks: 2' or 3' according to door size. Galvanized finish, 1.25 oz. sq. ft. Tracks to have GRADUATED SEAL for weather tight closing. Vertical tracks may be bracket mounted or continuous angle mounted and full adjustable for sealing door to jamb. Continuous angle size 2-1/2 x 1-3/4" x 1-1/8" on 2' track or 3-3/4 x 5" x 1/8" on 3" track. Horizontal track to be adequately reinforced with continuous angle.

- E. Hardware: All hinges and brackets made from 14 ga. galvanized steel. Track rollers shall be hardened steel ball bearing, minimum 10 -1/4" balls per roller.

- F. Spring Counter Balance: Heavy Duty oil tempered, helical wound, torsion springs mounted on a cross header steel shaft. Galvanized aircraft-type lifting cables shall have a minimum safety factor of 7 to 1.

- G. Lock: End stile friction type for inside security locking.

- H. Weather-stripping: Bottom door section shall have continuous flexible tubular vinyl weatherseal applied at factory to extruded aluminum retainer. Aluminum and vinyl jamb and header molding is available as an option.

- I. Wind Load: Doors designed to meet requirements of International Building Code. Deflection of door in horizontal position to be maximum 1/120 of door width.

- J. Glazing: Openings shall accommodate standard 1/4" double strength (DSB) glass.

2.2 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - 1. Lock Cylinders: Cylinders standard with manufacturer and keyed to building keying system.
 - 2. Keys: Three for each cylinder.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that wall openings are ready to receive work, and opening dimensions and tolerances are within specified limits.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.
- B. Install door unit assembly in accordance with manufacturer's instructions.
- C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- D. Fit and align door assembly, including hardware, level and plumb to provide smooth operation.
- E. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 92 00
- F. Install perimeter trim and closures.

3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.4 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation from Plumb: 1/16 inch.
- C. Maximum Variation from Level: 1/16 inch.
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft. straight edge.

3.5 CLEANING

- A. Clean doors, frames and glass.
- B. Remove labels and visible markings.

3.8 PROTECTION OF FINISHED WORK

- A. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION 08 36 13

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SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Storefront framing.
2. Exterior manual-swing entrance doors.
3. Entrance door hardware.

B. Related Sections:

1. Section 08 71 00 "Door Hardware" for storefront door cylinders.
2. Section 08 80 00 "Glazing" for storefront glazing.

1.2 PREINSTALLATION MEETINGS

- ##### A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- ##### A. Product Data: For each type of product.

- ##### B. Shop Drawings: Include plans, elevations, sections, full-size details, and attachments to other work.

1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
2. Provide detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.

- ##### C. Samples: For each exposed finish required.

- ##### D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.

- ##### E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- ##### F. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static air pressure differential of 20 percent of positive wind load design pressure, but not less than 6.24 lbf/sq. ft.

1.4 INFORMATIONAL SUBMITTALS

- A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.
- B. Product test reports.
- C. Field quality control test and inspection reports.
- D. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a) Thermal stresses transferring to building structure.
 - b) Glass breakage.
 - c) Noise or vibration created by wind and thermal and structural movements.
 - d) Loosening or weakening of fasteners, attachments, and other components.
 - e) Failure of operating units.
- C. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings.
- D. Deflection of Framing Members: At design wind pressure, as follows:
 - 1. Deflection Normal to Wall Plane: Limited to $1/175$ of clear span for spans up to 13 feet 6 inches and to $1/240$ of clear span plus $1/4$ inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to $3/4$ inch, whichever is less.
 - 2. Deflection Parallel to Glazing Plane: Limited to $1/360$ of clear span or $1/8$ inch, whichever is smaller.
 - a) Operable Units: Provide a minimum $1/16$ -inch clearance between framing members and operable units.
 - 3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
 - a) Perpendicular to Plane of Wall: No greater than $1/240$ of clear span plus $1/4$ inch for spans greater than 11 feet 8- $1/4$ inches or $1/175$ times span, for spans less than 11 feet 8- $1/4$ inches.
- E. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
1. Fixed Framing and Glass Area:
 - a) Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
 2. Entrance Doors:
 - a) Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
 - b) Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
- G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..
- H. Energy Performance: Certify and label energy performance according to NFRC as follows:
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.57 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.20 as determined according to NFRC 200.
 3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 35 as determined according to NFRC 500.
- I. Windborne-Debris Impact Resistance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone 3.
1. Large-Missile Test: For glazed openings located within 30 feet of grade.
- J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MANUFACTURERS

- A. Basis of Design Product: Subject to compliance with requirements, provide Kawneer products indicated on the drawings.

2.3 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Thermally broken.
 - 2. Glazing System: Retained mechanically with gaskets on four sides.
 - 3. Glazing Plane: Center or Front.
 - 4. Finish: Color anodic finish.
 - 5. Fabrication Method: Field-fabricated stick system.
- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Materials:
 - 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a) Sheet and Plate: ASTM B 209.
 - b) Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - c) Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d) Structural Profiles: ASTM B 308/B 308M.
 - 2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
 - a) Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b) Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c) Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
 - 1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

- a) Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
- 2. Door Design: Medium stile; 3-1/2-inch nominal width.
- 3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a) Provide nonremovable glazing stops on outside of door.

2.5 ENTRANCE DOOR HARDWARE

- A. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.
 - 1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.
 - a) Hardware Material: Manufacturer's standard stainless steel hardware components.
 - b) Finish: Brushed.
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 - 3. Opening-Force Requirements:
 - a) Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
 - 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- C. Butt Hinges: BHMA A156.1, Grade 1, radius corner.
 - 1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
 - 2. Exterior Hinges: Stainless steel, with stainless-steel pin. Tamper-proof style.
 - 3. Quantities:
 - a) For doors up to 87 inches high, provide three hinges per leaf.
- D. Continuous-Gear Hinges: Manufacturer's standard with stainless-steel bearings between knuckles, fabricated to full height of door and frame.

- E. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.
 - F. Manual Flush Bolts: BHMA A156.16, Grade 1.
 - G. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.
 - H. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
 - I. Cylinders: As specified in Section 08 71 00 "Door Hardware."
 - 1. Keying: Master key system. Permanently inscribe each key with a visual key control number and include notation to be furnished by Owner.
 - J. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
 - K. Operating Trim: BHMA A156.6.
 - L. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
 - 1. Color: Dark bronze to match door finish.
 - M. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
 - N. Weather Stripping: Manufacturer's standard replaceable components.
 - O. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
 - P. Silencers: BHMA A156.16, Grade 1.
 - Q. Thresholds: BHMA A156.21, raised thresholds with vinyl, neoprene or silicone rubber insert in face of stop. Maximum height of stop shall be 1/2 inch.
- 2.6 GLAZING
- A. Glazing: Comply with Section 08 80 00 "Glazing."
 - B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
 - C. Glazing Sealants: As recommended by manufacturer.

2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from exterior.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- D. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
- E. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
- F. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

- A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - 1. Color: Dark Bronze Anodized.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 6. Seal perimeter and other joints watertight unless otherwise indicated.

- B. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00 "Joint Sealants" to produce weathertight installation.
- D. Install components plumb and true in alignment with established lines and grades.
- E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- F. Install glazing as specified in Section 08 80 00 "Glazing."
- G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.2 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor shall engage a qualified testing agency to perform tests and inspections.
- B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.
 - 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
- C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.3 ADJUSTING

- A. Adjust moving components to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding. Lubricate hardware and other moving parts.

3.4 CLEANING AND PROTECTION

- A. Provide temporary protection on entrance doors and frames, and on any permanent door hardware installed for use during construction.
 - 1. Provide temporary protective coverings and strippable films on door base panels, and on door pulls and latches, to avoid damage to factory finishes during the construction period.
- B. Remove temporary protective coverings and strippable films prior to Substantial Completion. Clean installed products in accordance with manufacturer's instructions before Owner's acceptance. Do not use abrasive cleaners.
 - 1. Inspect components for surface (finish) damage. Any components that have sustained damage during construction shall be replaced at no cost to the owner.

3.5 HARDWARE SCHEDULE

- A. Entrance door hardware schedule shall be prepared using manufacturer's standard hardware, suited for exterior applications.
- B. Impact Resistant exterior entrance door hardware shall include, but not be limited to, the following components:
 - 1. Deadbolt package
 - 2. Hinges
 - 3. Concealed vertical rod panic hardware
 - 4. Offset pull sets
 - 5. Concealed vertical rod latchsets
 - 6. Mortise/rim cylinders
 - 7. Permanent cores (to match building standard)
 - 8. ADA-Compliant surface mounted closers (with coordinators for door pairs)
 - 9. Drip caps
 - 10. Weatherstripping package
 - 11. ADA-Compliant lip-type thresholds with weatherstripping

END OF SECTION 08 41 13

SECTION 08 71 00 - DOOR HARDWARE

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:
 - 1. Mechanical door hardware for the following:
 - a. Swinging doors.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
- B. Keying Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Door hardware schedule.
- C. Keying schedule.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedule.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC).

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: One year from date of Substantial Completion unless otherwise indicated below:
 - a. Exit Devices: Three years from date of Substantial Completion.
 - b. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- B. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the Florida Building Code – Accessibility, Seventh Edition (2020).

2.2 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

2.3 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 1. Bored Locks: Minimum 1/2-inch latchbolt throw.
 2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
- C. Lock Backset: 2-3/4 inches unless otherwise indicated.

- D. Lock Trim:
 - 1. Description: As indicated in door hardware schedule
 - 2. Levers: Cast.
 - 3. Escutcheons (Roses): Cast.
 - 4. Dummy Trim: Match lever lock trim and escutcheons.
- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
- F. Bored Locks: BHMA A156.2; Grade 2; Series 4000.
- G. Mortise Locks: BHMA A156.13; Operational Grade 2; stamped steel case with steel or brass parts; Series 1000.

2.4 AUXILIARY LOCKS

- A. Bored Auxiliary Locks: BHMA A156.36; Grade 2; with strike that suits frame.
- B. Mortise Auxiliary Locks: BHMA A156.36; Grade 2; with strike that suits frame.
- C. Narrow Stile Auxiliary Locks: BHMA A156.36; Grade 2; with strike that suits frame.

2.5 EXIT LOCKS AND EXIT ALARMS

- A. Exit Locks and Alarms: BHMA A156.29, Grade 1.

2.6 SURFACE BOLTS

- A. Surface Bolts: BHMA A156.16.

2.7 MANUAL FLUSH BOLTS

- A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.

2.8 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

- A. Automatic Flush Bolts: BHMA A156.3, Type 25; minimum 3/4-inch throw; with dust-proof strikes; designed for mortising into door edge. Include wear plates.

- B. Self-Latching Flush Bolts: BHMA A156.3, Type 27; minimum 3/4-inch throw; with dust-proof strikes designed for mortising into door edge. Include wear plates.

2.9 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices and Auxiliary Items: BHMA A156.3.

2.10 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide Schlage Classic "C" keyway for field keying.
- B. Standard Lock Cylinders: BHMA A156.5; Grade 2 permanent cores; face finished to match lockset.
 - 1. Core Type: Interchangeable.
- C. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

2.11 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference including, but not limited to:
 - 1. Providing the number of Grand-Master, Master, Cylinder Change keys.
 - 2. Re-keying installed cylinders to new keying system.
 - 3. Keyed Alike: Key all cylinders to same change key during construction.
- B. Keys: Nickel silver or Brass.

2.12 OPERATING TRIM

- A. Operating Trim: BHMA A156.6; aluminum unless otherwise indicated.

2.13 ACCESSORIES FOR PAIRS OF DOORS

- A. Astragals: BHMA A156.22.

2.14 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.15 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: BHMA A156.16.

2.16 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-thick aluminum; with manufacturer's standard machine or self-tapping screw fasteners.

2.17 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
- C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

3.2 ADJUSTING

- A. Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.3 DOOR HARDWARE SCHEDULE

- A. Registered hardware specialist shall submit a hardware schedule for review and approval. Note any electronic door access requirements as shown in the electrical drawings and specifications.

SECTION 08 80 00 - GLAZING

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:
 - 1. Glass for windows, doors, interior borrowed lites, and storefront framing.
 - 2. Glazing sealants and accessories.
 - 3. Glazing films and accessories.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of insulating glass unit (with film and without film).
- C. Film Samples: For semi-transparent film and for semi-transparent polyvinyl butyral interlayer (Contractor's Option).
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Preconstruction adhesion and compatibility test report.

1.6 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
1. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1. ACG Glass.
 2. Oldcastle Building Envelope TM.
 3. Pilkington North America.
 4. PPG Industries.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the International Building Code and ASTM E 1300.
1. Design Wind Pressures: As indicated on Drawings.
 2. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- B. Windborne-Debris-Impact Resistance: Exterior glazing shall comply with basic -protection testing requirements in ASTM E 1996 for Wind Zone 3 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on Project and shall be installed in same manner as glazing indicated for use on Project.
1. Large-Missile Test: For glazing located within 30 feet of grade.
 2. Small-Missile Test: For glazing located more than 30 feet above grade.

- C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 - 2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 - 3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
- D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- C. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

2.5 LAMINATED GLASS

- A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - 1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
 - 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.
- B. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with requirements specified above for laminated glass except laminate glass with one of the following to comply with interlayer manufacturer's written instructions:
 - 1. Polyvinyl butyral interlayer.

2.6 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
 - 1. Sealing System: Dual seals.
 - 2. Spacer: Manufacturer's standard spacer material and construction.

2.7 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3. Colors of Exposed Glazing Sealants: As indicated by manufacturer's designations.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a) Dow Corning Corporation; 790.
 - b) May National Associates, Inc.; Bondaflex Sil 290.
 - c) Pecora Corporation; 890NST.
 - d) Sika Corporation; Sikasil WS-290.
 - e) Tremco Incorporated; Spectrem 1.

2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 - 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- B. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- C. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- E. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- F. Glazing Film: Self-adhering sheet film.
 - 1. Basis of Design Product: Provide 3M products indicated on the drawings.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Install glazing film in accordance with manufacturer's written instructions.
 - 1. Install film on interior face of glass. Thoroughly clean glass face prior to installing film.

3.2 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Apply heel bead of elastomeric sealant.
- F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.3 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation. Install gaskets to protrude past face of glazing stops.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners. Install gaskets to protrude past face of glazing stops.

- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

3.4 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.

3.6 INSULATING-LAMINATED-GLASS SCHEDULE

- A. Glass Type G-1: Low-E coated tinted insulating laminated glass with frosted film.
 - 1. Overall Unit Thickness: 1-5/16 inch.
 - 2. Minimum Thickness of Outdoor Lite: 1/4 inch.
 - 3. Outdoor Lite: 1/4 inch PPG Solarban 60 Clear; Low-E #2.
 - 4. Interspace Content: 1/2 inch air fill.

5. Indoor Lite: Clear laminated glass with two plies of heat-strengthened float glass.
 - a) Minimum Thickness of Each Glass Ply: 1/4 inch.
 - b) Interlayer Thickness: 0.090 inch.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.27 maximum.
8. Solar Heat Gain Coefficient: 0.25 maximum.
9. Tint Color: Light gray-green.
10. Semi-Transparent Film: 3M semi-transparent product; transparency to be determined by Architect during shop drawing submittal review.
11. Semi-Transparent Polyvinyl Butyral Interlayer (Contractor's Option): Transparency to be determined by Architect during shop drawing submittal review.

B. Glass Type G-2: Low-E coated tinted insulating laminated glass. Large and small object impact rated.

1. Overall Unit Thickness: 1-5/16 inch.
2. Minimum Thickness of Outdoor Lite: 1/4 inch.
3. Outdoor Lite: 1/4 inch PPG Solarban 60 Clear; Low-E #2.
4. Interspace Content: 1/2 inch air fill.
5. Indoor Lite: Clear laminated glass with two plies of heat-strengthened float glass.
 - a) Minimum Thickness of Each Glass Ply: 1/4 inch.
 - b) Interlayer Thickness: 0.090 inch.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.27 maximum.
8. Solar Heat Gain Coefficient: 0.25 maximum.
9. Tint Color: Light gray-green.

3.7 LAMINATED GLASS SCHEDULE

A. Glass Type G-3: Tinted laminated glass with two plies of annealed fully tempered float glass.

1. Minimum Thickness of Each Glass Ply: 1/4 inch.
2. Interlayer Thickness: 0.060 inch.
3. Safety glazing required on exposed faces of glass lite.
4. Tint Color: Light gray-green.

3.8 MONOLITHIC GLASS SCHEDULE

A. Glass Type G-4: Clear annealed, fully tempered float glass. Impact resistant (Lexan or equal)

1. Minimum Thickness: 1/4 inch.
2. Safety glazing required.

END OF SECTION 08 80 00

SECTION 09 05 61 - COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. This section applies to floors identified in contract documents that are receiving the following types of floor coverings:
 - 1. Resilient tile.
 - 2. Carpet tile.
 - 3. Thin-set ceramic tile and stone tile.
 - 4. ~~Epoxy Resinous Flooring.~~
- B. Removal of existing floor coverings.
- C. Preparation of new and existing concrete floor slabs for installation of floor coverings.
- D. Testing of concrete floor slabs for moisture and alkalinity (pH).
- E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
 - 1. Contractor shall perform all specified remediation of concrete floor slabs.

1.2 RELATED REQUIREMENTS

- A. Section 01 40 00 - Quality Requirements: Additional requirements relating to testing agencies and testing.
- B. Section 03 30 00 - Cast-in-Place Concrete: Limitations on curing requirements for new concrete floor slabs.

1.3 REFERENCE STANDARDS

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.
- C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2011.
- D. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.5 SUBMITTALS

- A. Visual Observation Report: For existing floor coverings to be removed.
- B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
 - 1. Moisture and alkalinity (pH) limits and test methods.
 - 2. Manufacturer's required bond/compatibility test procedure.

- C. Testing Agency's Report:
 1. Description of areas tested; include floor plans and photographs if helpful.
 2. Summary of conditions encountered.
 3. Moisture and alkalinity (pH) test reports.
 4. Copies of specified test methods.
 5. Recommendations for remediation of unsatisfactory surfaces.
 6. Submit report to Architect.
 7. Submit report not more than two business days after conclusion of testing.
- D. Adhesive Bond and Compatibility Test Report.
- E. Copy of RFCI (RWP).
- F. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation. Submit only if test results indicate conditions that are unsatisfactory to finish flooring manufacturer.
 1. Manufacturer's qualification statement.
 2. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
 3. Manufacturer's installation instructions.
 4. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

1.6 QUALITY ASSURANCE

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
 1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
 2. Acceptable Testing Agencies:
 - a. Independent Floor Testing & Inspection, Inc. (IFTI): www.ifti.com/#sle.
 - b. Other testing agency approved by Owner.
- C. Contractor's Responsibility Relating to Independent Agency Testing:
 1. Provide access for and cooperate with testing agency.
 2. Confirm date of start of testing at least 10 days prior to actual start.
 3. Allow at least 4 business days on site for testing agency activities.
 4. Achieve and maintain specified ambient conditions.
 5. Notify Architect when specified ambient conditions have been achieved and when testing will start.
- D. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

1.8 FIELD CONDITIONS

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

PART 3 EXECUTION

3.1 CONCRETE SLAB PREPARATION

- A. Perform following operations in the order indicated:
 - 1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
 - a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
 - b. Removal of existing floor covering.
 - 2. Preliminary cleaning.
 - 3. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
 - 4. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 5. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 6. Specified remediation, if required.
 - 7. Patching, smoothing, and leveling, as required.
 - 8. Other preparation specified.
 - 9. Adhesive bond and compatibility test.
 - 10. Protection.
- B. Remediations:
 - 1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
 - 2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.

3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.2 REMOVAL OF EXISTING FLOOR COVERINGS

- A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.
- B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.3 MOISTURE VAPOR EMISSION TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
- F. Report: Report the information required by the test method.

3.4 INTERNAL RELATIVE HUMIDITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F2170 Procedure A and as follows.
- D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- F. Report: Report the information required by the test method.

3.5 ALKALINITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
- C. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
- D. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.6 ADHESIVE BOND AND COMPATIBILITY TESTING

- A. Comply with requirements and recommendations of floor covering manufacturer.

END OF SECTION

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SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

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:
 - 1. Non-load-bearing steel framing systems for interior partitions.
 - 2. Suspension systems for interior soffits and ceilings.
 - 3. Sub-blocking for exterior siding.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For embossed steel studs and runners firestop tracks, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 10 lbf/sq. ft.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

- B. Studs and Runners: ASTM C645. Use either steel studs and runners.
 - 1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: As indicated on Drawings.
 - b. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to runners while allowing 1-1/2-inch minimum vertical movement.
 - 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
- D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Metal Thickness: 0.0269 inch .

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Wire Hangers: ASTM A641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- C. Carrying Channels (Main Runners): Cold-rolled, commercial steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.
- D. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
 - 2. Steel Studs and Tracks: ASTM C 645.
 - 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - 4. Z-Shaped, Rigid Furring Channels: Galvanized 1/2 inch deep.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
 - 2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.

- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- E. Direct Furring:
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

3.3 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a) Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

- a) Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - 3. Wire Hangers: Secure 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 hangers to deteriorate or otherwise fail.
 - 4. Do not attach hangers to steel roof deck.
 - 5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 7. Do not connect or suspend steel framing from ducts, pipes, or conduit
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 09 22 16

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SECTION 09 29 00 - GYPSUM BOARD

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:
 - 1. Interior gypsum board.
 - 2. Tile backing panels.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Gypsum wallboard.
 - 2. Gypsum board, Type X.
 - 3. Gypsum ceiling board.
 - 4. Mold-resistant gypsum board.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C1396/C1396M.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- B. Gypsum Board, Type X: ASTM C1396/C1396M.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- C. Gypsum Ceiling Board: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
- D. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.
1. Core: 5/8 inch, Type X.
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.3 TILE BACKING PANELS

Tile backing panels may be specified in this Section or in Section 09 30 13 "Ceramic Tiling."

- A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.
1. 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:
 - a. CertainTeed Corporation.
 - b. Georgia-Pacific Building Products.
 - c. National Gypsum Company.
 - d. USG Corporation.
 2. Core: 5/8 inch15.9 mm, Type X.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- B. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges.
1. 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:
 - a. CertainTeed Corporation.
 - b. Custom Building Products.
 - c. National Gypsum Company.
 - d. USG Corporation.
 2. Thickness: 5/8 inch15.9 mm.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, or paper-faced galvanized-steel sheet.
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. Expansion (control) joint.

2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
 1. Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

2.6 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

PART 3 - EXECUTION

3.1 INSTALLATION AND FINISHING OF PANELS

- A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- B. Comply with ASTM C840.
- C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- D. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- E. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."
 - 3. Level 5: Where indicated on Drawings.
 - a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."
- H. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.
- I. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.2 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 09 29 00

SECTION 09 30 00 - TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Ceramic trim.
- D. Non-ceramic trim.

1.02 REFERENCE STANDARDS

- A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2014.
- B. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- C. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2010).
- D. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).
- E. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- F. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).
- G. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).
- H. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).
- I. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).
- J. ANSI A108.11-SystemDeleted - American National Standard for Interior Installation of Cementitious Backer Units; 2010 (Revised).
- K. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior glue plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- L. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2010).
- M. ANSI A118.1 - American National Standard Specifications for Dry-Set Cement Mortar; 2012 (Revised).

- N. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).
- O. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Revised).
- P. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation; 2014.
- Q. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone Installation; 2014.
- R. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2012.
- S. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2013.1.
- T. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2015.

1.03 SUBMITTALS

- A. See Section 01 30 00 - 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: Minimum 4 by 4 inches in size illustrating pattern & color variations.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include recommended cleaning methods, cleaning materials & stain removal methods.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Tile: 5 percent of each size, color, and surface finish combination.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.
- B. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.
- C. Store tile & cementitious materials on elevated platforms, under cover & in a dry location.
- D. Store aggregates where grading & other required characteristics can be maintained & contamination avoided.
- E. Store liquid latexes & emulsion adhesives in unopened containers & protected from freezing.

1.05 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials, or comply with manufacturer's written instructions (whichever is more stringent).
- C. Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 PRODUCTS

2.01 TILE

- A. Note that the term "Ceramic Tile" used in this Section is a generic term that may refer to Ceramic Tile, Porcelain Tile, Quarry Tile, Glazed Tile, or other Hard Tile products indicated.
- B. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI 137.1, "Specifications for Ceramic Tile", for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
 - 2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
- C. Factory Blending: For tile exhibiting color variations within ranges selected during sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved samples.
- D. Tile Products: As indicated on drawings.

2.02 TRIM AND ACCESSORIES

- A. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
 - 1. Manufacturers: Same as for tile. See drawings.
- B. Non-Ceramic Trim: Satin brass anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
 - 1. Applications:
 - a. All other junctions between tile floor and other finish floors: As selected by Architect from the following manufacturer's standard product line:
 - 1) Manufacturer:
 - (a) Schluter-Systems: www.schluter.com.
 - b. Expansion and control joints, floor and wall.
 - 1) Manufacturer: As selected by Architect from the following manufacturer's standard product line:
 - (a) Schluter-Systems: www.schluter.com.

2.03 SETTING MATERIALS

- A. Latex-Portland Cement Mortar Bond Coat: 1.
 - 1. Products:
 - a. ARDEX Engineered Cements; ARDEX N 23 MICROTEC: www.ardexamericas.com.
 - b. AVM Industries, Inc; Thin-Set 780: www.avmindustries.com.

- c. LATICRETE International, Inc; LATICRETE 254 Platinum
 - d. Merkrete, by Parex USA, Inc; Merkrete 735 Premium Flex
 - e. ProSpec, an Oldcastle brand; Permalastic System
- B. Dry-Set Portland Cement Mortar Bond Coat: ANSI A118.1.
- 1. Products:
 - a. ProSpec, an Oldcastle brand; PermaSet 200: www.prospec.com.

2.04 GROUTS

- A. Manufacturers:
- 1. ARDEX Engineered Cements; _____: www.ardexamericas.com/#sle.
 - 2. Bostik Inc; _____: www.bostik-us.com/#sle.
 - 3. Merkrete, by Parex USA, Inc; Merkrete Duracolor Non-Sanded Color Grout: www.merkrete.com/#sle.
- B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
- 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
 - 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
 - 3. Color(s): As selected by Architect from manufacturer's full line.
 - 4. Products:
 - a. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
 - b. Merkrete, by Parex USA, Inc; Merkrete Pro Grout: www.merkrete.com/#sle.
 - c. ProSpec, an Oldcastle brand; ProColor Sanded Tile Grout: www.prospec.com.
- C. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
- 1. Application:
 - a. All grout on floor.
 - b. At junction between tile and adjacent fixtures, where tile does not run behind fixtures.

2.05 ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
- 1. Thickness: 20 mils, maximum.
 - 2. Crack Resistance: No failure at 1/16 inch gap, minimum.
 - 3. Products:
 - a. LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
 - b. Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/#sle.
 - 4. Locations: Provide at all tiled floors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- 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 tile.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor 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. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

- A. Provide leveling clips as needed for a flush and level tile installation.
- B. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a thru A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
- C. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- D. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor and base joints.
- E. 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.
- F. Form internal angles square and external angles bullnosed.
- G. Install non-ceramic trim in accordance with manufacturer's instructions.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Keep control and expansion joints free of mortar, grout, and adhesive.
- J. Keep expansion joints free of adhesive or grout. Apply sealant to joints.
- K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- L. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- M. 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.
- N. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

- O. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- P. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- Q. Jointing Pattern: As indicated in drawings.
- R. Control and Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Locate joints in tile surfaces directly above joints in concrete substrates. If there are no sub-floor control joints, place control joints 10 feet to 15 feet in all directions, depending on the size of the room and tile layout. If columns are present, control joints shall run between each column.
 - 2. Provide control and expansion joints for tile work in accordance with the recommendations of the Tile Council of America, Inc. Seal joints with appropriate long life sealant.
- S. Grout tile to comply with requirements of the following tile installation standards:
 - 1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over exterior concrete substrates, install in accordance with TCNA (HB) Method F102, with standard grout.
- B. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
 - 1. Use uncoupling membrane under all tile unless other underlayment is indicated.
 - 2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

3.05 INSTALLATION - WALL TILE

- A. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

3.06 CLEANING

- A. Clean tile and grout surfaces.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.
4. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

3.07 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.
- B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- C. Before final inspection, remove protective coverings.

END OF SECTION

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SECTION 09 51 00 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Acoustical units.

1.02 REFERENCE STANDARDS

- A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
- C. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.
- D. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.
- E. UL (FRD) - Fire Resistance Directory; current edition.

1.03 ADMINISTRATIVE REQUIREMENTS

- 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. Do not install acoustical units until after interior wet work is dry.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on suspension system components.
- C. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.
- D. Samples: Submit two samples each, 12 inches long, of suspension system main runner.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.05 QUALITY ASSURANCE

- A. Fire-Resistive Assemblies: Complete assembly listed and classified by UL (FRD) for the fire resistance indicated.
- B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc: www.armstrong.com.
 - 2. Acoustic Ceiling Products, Inc: www.acpideas.com.
 - 3. CertainTeed Corporation: www.certainteed.com.
 - 4. Hunter Douglas Contract: www.hunterdouglascontract.com.
 - 5. USG: www.usg.com.
- B. Suspension Systems:
 - 1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

- A. See schedule at the end of this specification.

2.03 SUSPENSION SYSTEM(S)

- A. See schedule at the end of this specification.

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. 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 and manufacturer's instructions and 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. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- E. 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.

- F. 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.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.
- J. Install light fixture boxes constructed of gypsum board above light fixtures in accordance with fire rated assembly requirements and light fixture ventilation requirements.

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. Fit border trim neatly against abutting surfaces.
- D. Install units after above-ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. 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.
- G. Where round obstructions occur, provide preformed closures to match perimeter molding.
- H. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.
- I. Install hold-down clips on panels within 20 ft of an exterior door.

3.04 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.05 SCHEDULE

- A. ACOUSTICAL PANEL CEILING AND SUSPENSION SYSTEM SCHEDULE:
 - 1. Acoustical Ceiling Tile System: Type ACT-1:
 - a. Basis of Design: Mars High NRC High CAC, 86345 as manufactured by USG Interiors, LLC, or equivalent.
 - 1) Schedule: See drawings for locations
 - 2) Surface Texture: Light
 - 3) Composition: Mineral Fiber
 - 4) Color: White
 - 5) Size: 24in X 24in X 1in
 - 6) Edge Profile: Square
 - 7) Noise Reduction Coefficient (NRC): 0.80
 - (a) ASTM C 423; Classified with UL label on product carton

- 8) Ceiling Attenuation Class (CAC): 40
 - (a) ASTM C 1414; Classified with UL label on product carton
- 9) Articulation Class (AC): 180
 - (a) ASTM E 1111; Classified with UL label on product carton
- 10) Emissions Testing: Section 01350 Protocol, < 13.5 ppb of formaldehyde when used under typical conditions required by ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality"
- 11) Flame Spread: ASTM E 1264; Class A (UL)
- 12) Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.90
- 13) Dimensional Stability: HumiGuard Plus - Temperature is between 32°F (0° C) and 120°F (49° C). It is not necessary for the area to be enclosed or for HVAC systems to be functioning. All wet work (plastering, concrete, etc) must be complete and dry.
- 14) Antimicrobial Protection: Inherent - Resists the growth of mold/mildew and bacterial growth.

2. Acoustical Ceiling Tile System: Type ACT-2:

- a. Basis of Design: Sheetrock Brand Panel, 3260 as manufactured by USG Interiors, LLC, or equivalent.
 - 1) Schedule: See drawings for locations
 - 2) Surface Texture: Smooth
 - 3) Composition: Gypsum board
 - 4) Color: White
 - 5) Size: 24in X 24in X 1/2in
 - 6) Edge Profile: Square for interface with DX/DXL with SLT
 - 7) Ceiling Attenuation Class (CAC): 35
 - (a) ASTM C 1414; Classified with UL label on product carton
 - 8) Flame Spread: ASTM E 1264; Class A (UL)
 - 9) Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.77
 - 10) Antimicrobial Protection: Inherent - Resists the growth of mold/mildew and bacterial growth.

3. Typical Suspension System

- a. Unless noted otherwise the following shall be the typical suspension system.
- b. Main and cross runners roll formed from cold-rolled steel sheet hot dipped galvanized, with prefinished 15/16 inch wide flanges, other characteristics as follows:
- c. Shall be either equal to USG Donn DX/DXL Square Edge 15/16" Exposed Tee or equal to Armstrong Prelude XL 15/16 inch #7300 Exposed Tee.
- d. Structural Classification: Intermediate Duty
- e. Face Finish: Flat White

END OF SECTION

SECTION 09 54 23 – EXTERIOR LINEAR METAL CEILING SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Perforated and non-perforated metal ceiling panels
2. Acoustical backing
3. Suspension systems
4. Accessories; provide other necessary items including devices for attachment overhead construction, secondary members, splines, splices, connecting clips, wall connectors, wall angles, and other devices required for a complete installation.
5. Supplemental support framing: Provide fully engineered secondary framing as required to meet code, conforming to layout shown in drawings, to support direct-hung metal ceilings suspension system.

- B. Related Sections / Work:

1. Sections 05 40 00 – Cold-Formed Metal Framing

- C. This Section covers the general requirements only for Acoustical Metal Ceilings as shown on the drawings. The supplying and installation of additional accessory features and other items not specifically mentioned herein, but which are necessary to make a complete installation, shall also be included or clarified accordingly.

- D. Qualification Data:

1. Test Reports: Certified reports from independent agency substantiating structural compliance to windloads and other governing requirements.
2. Certificates:
 - a. Data substantiating manufacturer and installer qualifications.
 - b. Certified data attesting fire rated materials comply with specifications.
3. Manufacturer's Instructions: Detailed installation instructions and maintenance data.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM)

1. E 84 – “Standard Test Method for Surface Burning Characteristics of Building Materials”
2. E 488 – “Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements”
3. B 209 – “Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate”

4. C 423 – “Sound Absorption and Sound Absorption Coefficients by Reverberation Room Method”
5. E 580 – “Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint”
6. C 635 – “Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings”
7. C 636 – “Recommended Practice for Installation of Metal Ceiling Suspensions Systems for Acoustical and Lay-in Panels”
8. A 641 – “Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire”
9. A 653 – “Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip process”
10. E 1264 – “Classification for Acoustical Ceiling Products”
11. E 1477 – “Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by use of Integrating-Sphere Reflectometers”
12. D 1044 – “Practice for Abrasion Resistance”
13. D 1002 – “Practice for Adhesion Resistance”

1.4 SUBMITTALS

- A. Product Data: Manufacturer’s published literature, including specifications.
- B. Product Certification: Manufacturer’s certifications that products comply with specified requirements and governing codes including product data, laboratory test reports and research reports showing compliance with specified standards.
- C. Shop Drawings: Submit shop drawings for reflected ceiling plans (RCP’s), drawn to scale, and indicating penetrations and ceiling mounted items. Show the following details:
 1. Reflected Ceiling Plan(s): Indicating metal ceiling layout, ceiling mounted items and penetrations.
 2. Suspension System, Carrier and Component Layout.
 3. Details of system assembly and connections to building components.
- D. Samples for Verification: Full-size units (or as specified below) of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics. Submit samples for each type specified.
 1. 11" square metal panel units.
 2. 11" long samples of each exposed molding or trim.
 3. 11" long samples of each suspension component.

1.5 QUALITY ASSURANCE

- A. Manufacturer/Installer Qualifications:
 1. Provide metal ceiling system components produced by a single manufacturer with a minimum 10 years’ experience in actual production of specified products and with resources to provide consistent quality in appearance and physical properties, including production in an environmentally controlled indoor factory facility and having previously certified Miami-Dade County NOA certifications.

2. Provide suspension system components produced by a single manufacturer to provide compatible components for a complete metal ceiling system installation.
3. Perform installations using a firm with installers having no less than 3 years of successful experience on projects of similar size and requirements.

B. Regulatory Requirements:

1. Fire Rating Performance Characteristics: Install system to provide a flame spread of 0 - 25, complying with certified testing to ASTM E 84.
2. Structural Criteria: Install and certify system to comply with structural and wind load requirements of governing codes.
3. Installation Standard for Suspension System: Comply with ASTM C 636.
4. Wind Load: Per code. Designed and tested in accordance with the requirements of the Florida Building Code 6th edition (2017), including the High Velocity Hurricane Zone (HVHZ) provisions and Miami-Dade requirements. Miami-Dade County, Florida Notice of Acceptance No. 20-0203.01 (expires 3/19/25).

C. Mock-Up: Prior to beginning installation erect a mock-up section, where directed, using all system components.

D. Pre-installation Conference: Conduct a conference, prior to start of installation, to review system requirements, shop drawings, and all coordination needs.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver system components in manufacturer's original unopened packages, clearly labeled.
- B. Store components in fully enclosed dry space. Carefully place on skids, to prevent damage from moisture and other construction activities.
- C. Handle components to prevent damage to surfaces and edges, and to prevent distortion and other physical damage.

1.7 PROJECT CONDITIONS

- A. Begin system installations only after spaces are enclosed and weather-tight, and after all wet work and overhead work have been completed.
- B. Prior to starting installations, allow materials to reach ambient room temperature and humidity intended to be maintained for occupancy.

1.8 WARRANTY

- A. Provide specified manufacturer's warranty against defects in workmanship, discoloration, or other defect considered undesirable by the Architect or Employer.
- B. This warranty shall remain in effect for a minimum period of one (1) year from date of initial acceptance.

1.9 MAINTENANCE & EXTRA MATERIALS

- A. Maintenance Instructions: Provide manufacturer's standard maintenance and cleaning instructions for finishes provided.
- B. Extra Materials: Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents. Only typical system components are included with attic stock.
 - 1. Acoustical Metal Ceiling Pan Units: Full-size units equal to two percent (2%) of amount installed.
 - 2. Ceiling Suspension System Components: Quantity of each grid and exposed component equal to two percent (2%) of amount installed.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Provide 150F metal plank ceiling system manufactured by CertainTeed Architectural, 5015 Oakbrook Parkway, Suite 100, Norcross, GA 30093. Tel: (800) 366-4327; or approved equal.

2.2 SYSTEM MATERIALS

- A. Linear metal plank soffit system for exterior installations:
 - 1. Miami-Dade County, Florida Notice of Acceptance No. 20-0203.01 (expires 3/19/25).
- B. Panel Profile Type: 150F, roll formed .025" thick aluminum; 5-29/32" (150 mm) wide, 3/4" deep, with square interlocking, integral reveal closure edges.
 - 1. Length: as required - 20 ft. maximum
- C. Suspension System (Concealed):
 - 1. Carrier: V-shaped roll-formed aluminum section with hook-shaped tabs spaced to receive panels. Finish is factory applied black enamel.
 - 2. Hanger Wire: 12 Ga. galvanized carbon steel.
 - 3. Seismic/Wind Uplift Compression Struts: Verify and insert proper sizes required to comply with governing codes, as designed by registered structural engineer.
- D. Perforations for ventilation only
 - 1. Pattern: Non-perforated, #124 vent panels as required at eave/soffit.
 - 2. Percentage of soffit – 10%
- E. Panel Finish: Paint; color to be selected by architect
 - 1. Luxacote Exterior Paint

2. Powder Coat
3. Decorated Wood-Look Powder Coat

2.3 ACCESSORY MATERIALS

- A. Panel Splice: Formed aluminum finished in matching color
- B. Edge trim: Manufacturer's standard edge trim moldings.
- C. Air Distribution Devices: Provide distribution devices that are independently suspended, relocatable, adjustable from below finished ceiling, and capable of being concealed behind (invisible to view) and fully integrated with ceiling system so as to allow no interruption of ceiling components.
- D. Lighting Fixtures: Provide fixtures capable of being fully integrated with ceiling system and requiring no interruption of ceiling components, that are independently suspended, and as selected to conform to lighting criteria specified in Division 16.

PART 3- EXECUTION

3.1 EXAMINATION

- A. Examine substrates and structural framing to which acoustical metal panels attach or abut, with installer present, for compliance with requirements specified in this and other Sections that affect installation and anchorage, and other conditions affecting performance of metal panel ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.
- B. Measure each ceiling area and establish layout of acoustical metal pan units to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width units at borders, and comply with layout shown on reflected ceiling plans.
- C. Survey substrate for wall attachment to assure squareness and proper elevation for wall panel installation.

3.3 INSTALLATION

- A. General: Install acoustical metal pan ceilings, per manufacturers shop drawings provided, per manufacturer's written instructions and to comply with publications referenced below.
 1. CISCA "Ceiling Systems Handbook"
 2. Standard for Ceiling Suspension System Installations - ASTM C 636
 3. Standard for Ceiling Suspension Systems Requiring Seismic Restraint - ASTM E 580
 4. IBC (International Building Code) Standard for Seismic Zone for local area

- B. Suspend ceiling hangers from building's approved structural substrates and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produce hanger spacings that interfere with location of hangers at spacing required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Utilize supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 4. Where used secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Space hangers not more than 48" on-center, along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 12" from ends of each member. Supply supporting calculations from licensed Structural Engineer verifying hanger spacing meets all requirements, when spacing exceeds those recommended.
 6. Level grid to 1/8" in 10' from specified elevation(s), square and true.
 7. Adjust suspension system runners so they are square (within .5 degree from 90 degrees) and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- C. Secure bracing wires to ceiling suspension members and to supports acceptable to Architect/Engineer and/or inspector. Suspend bracing from building's structural members and/or structural deck, as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs (unless directed otherwise).
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical metal pan. Method of edge trim attachment and design of edge trims to be approved by Architect.
1. Screw attach moldings to substrate at intervals not more than 18" on-center and not more than 6" from ends, leveling with ceiling suspension system to a tolerance of 1/8" in 10'. Miter corners accurately and connect securely.
 2. Do not use exposed fasteners, including pop rivets, on moldings and trim without prior written approval, or unless detailed otherwise.
- E. Scribe and cut acoustical metal panel units for accurate fit at penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
- F. Install acoustical metal panel units in coordination with suspension system. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.

3.4 ADJUST AND CLEAN

- A. Adjust components to provide uniform tolerances.
- B. Replace all ceiling panels that are scratched, dented or otherwise damaged.
- C. Clean exposed surfaces with non-solvent, non-abrasive commercial type cleaner.

END OF SECTION

SECTION 09 65 00 – RESILIENT FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Resilient base.
- C. Installation accessories.

1.2 REFERENCE STANDARDS

- A. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).

1.3 SUBMITTALS

- A. See Section 01 30 00 - 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. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- D. Verification Samples: Submit two samples, 9 by 12 inch in size illustrating color and pattern for each resilient flooring product specified.
- E. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Flooring Material: Quantity equivalent to 5 percent of each type and color.
 - 3. Extra Wall Base: Quantity equivalent to 5 percent of each type and color.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Do not double stack pallets.

1.5 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 to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.1 TILE FLOORING

- A. Luxury Vinyl Tile Flooring (LVT): As indicated in drawings.

2.2 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
 - 1. Height: As indicated on drawings.
 - 2. Thickness: 0.125 inch.
 - 3. Length: Roll with outside corners
 - 4. Color: As indicated on drawings.

2.3 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. Filler for Coved Base: Plastic.

PART 3 EXECUTION

3.1 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 Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
- D. Coordinate installation with requirements for Concrete Floor Moisture Testing, and Water Vapor Emission Control System per the manufacturer's product recommendations.
 - 1. 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.

3.2 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
- C. Prohibit traffic until filler is fully cured.
- D. Clean substrate.

3.3 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Spread only enough adhesive to permit installation of materials before initial set.
- D. Fit joints and butt seams tightly.
- E. Set flooring in place, press with heavy roller to attain full adhesion.
- F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- G. 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.
- H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.4 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.

3.5 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Install base on solid backing. Bond tightly to wall and floor surfaces with impermeable caulk.
- C. Scribe and fit to door frames and other interruptions.

3.6 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.7 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation, or as required by finish flooring manufacturer (whichever is more stringent).

END OF SECTION

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SECTION 09 68 13 - TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

- A. Section 09 05 61 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

- A. See Section 01 30 00 - 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 two carpet tiles illustrating color and pattern design for each carpet color selected.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Carpet Tiles: Quantity equal to 10 percent of total installed of each color and pattern installed.

1.05 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.

1.06 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. Manufacturers and products shall be as indicated on drawings.

2.02 MATERIALS

- A. Tile Carpeting:
 - 1. Product: As indicated on the Drawings.

2.03 ACCESSORIES

- A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Edge Strips: As noted in drawings.
- C. Adhesives: Acceptable to carpet tile manufacturer, compatible with materials being adhered; maximum VOC of 50 g/L; CRI Green Label certified; in lieu of labeled product, independent test report showing compliance is acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- 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 carpet tile.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.
- D. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
 - 1. Test in accordance with Section 09 05 61.
 - 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions and CRI Carpet Installation Standard.
- 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. Locate change of color or pattern between rooms under door centerline.
- F. Fully adhere carpet tile to substrate.
- G. Trim carpet tile neatly at walls and around interruptions.
- H. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 91 14 - EXTERIOR PAINTING

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:
 - 1. Surface preparation and application of paint systems on the following exterior substrates:
 - a. Concrete Surfaces.
 - b. Steel and iron
 - c. Galvanized metal.
 - d. Cementitious siding materials

1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in the Exterior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, available manufacturers that may be incorporated into the Work include, but are not limited to the following:
 - 1. Behr Process Corporation
 - 2. Benjamin Moore & Co.
 - 3. Dulux (formerly ICI Paints); a brand of AkzoNobel.
 - 4. Glidden Professionals.
 - 5. Sherwin-Williams Company (The).

2.2 PAINT PRODUCTS

- A. MPI Standards: Provide products complying with MPI standards indicated and listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As indicated on the drawings or as selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected. Application of coating indicates acceptance of surfaces and conditions.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Existing Painted Stucco Surfaces: Pressure wash clean to remove all dirt, grime and organic growths. Remove any loose or flaking previously applied coatings before commencing with any painting.
 - 1. Spot prime bare or repaired existing surfaces before commencing with application of new topcoats.

3.3 APPLICATION

- A. Apply paints in accordance with manufacturer's written instructions and recommendations in "MPI Manual."
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

- A. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Traffic Surfaces:
 - 1. Clear Water-Based Sealer System MPI EXT 3.2H:
 - a. Prime Coat: Sealer, water based, matching topcoat.
 - b. Intermediate Coat: Sealer, water based, matching topcoat.
 - c. Topcoat: Sealer, water based for concrete floors, MPI #99.
- B. Steel and Iron Substrates:
 - 1. Alkyd System MPI EXT 5.1C:

- a. Alkyd Prime Coat: Primer, alkyd, anti-corrosive for metal, MPI #79.
- b. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
- c. Semigloss Topcoat: Alkyd, exterior, semigloss (MPI Gloss Level 5), MPI #94.

C. Galvanized-Metal Substrates:

1. Alkyd System MPI EXT 5.3B:

- a. Prime Coat: Primer, galvanized, cementitious, MPI #26.
- b. Intermediate Coat: Exterior alkyd enamel, matching topcoat.
- c. Semigloss Topcoat: Alkyd, exterior, semigloss (MPI Gloss Level 5), MPI #94.

D. Cement Board Substrates:

1. Latex System MPI EXT 3.3A:

- a. Latex Prime Coat: Exterior, matching topcoat.
- b. Intermediate Coat: Latex, exterior, matching topcoat.
- c. Flat Topcoat: Latex, exterior, flat (MPI Gloss Level 1), MPI #10.

END OF SECTION 09 91 14

SECTION 09 91 24 - INTERIOR PAINTING

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 surface preparation and the application of paint systems on the following interior substrates:
 - 1. Steel and iron.
 - 2. Galvanized metal.
 - 3. Gypsum board.
 - 4. Concrete
 - 5. Concrete Masonry Units

1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Product List: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Product: Subject to compliance with requirements, provide Sherwin-Williams and Benjamin Moore products indicated on the drawings.

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As indicated on the drawings.
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Gypsum Board: 12 percent.
 - 2. Concrete: 15 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
- C. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

- A. Steel Substrates:
 - 1. Waterborne Light Industrial Coating MPI INT 3.1L-G5:
 - a. Prime Coat: Primer, alkyd, anti-corrosive for metal, MPI #79
 - b. Intermediate Coat: Light Industrial Coating, interior, water based, matching top-coat.
 - c. Topcoat: Light Industrial Coating, interior, water based, semi-gloss (MPI Gloss Level 5), MPI#153.
- B. Galvanized-Metal Substrates:

1. Waterborne Light Industrial Coating MPI INT 3.1L-G3:
 - a. Prime Coat: Primer, galvanized, water based, MPI #134.
 - b. Intermediate Coat: Light Industrial Coating, interior, water based, matching topcoat.
 - c. Topcoat: Light Industrial Coating, interior, water based, semi-gloss (MPI Gloss Level 5), MPI#153.

- C. Gypsum Board Substrates:
 1. Institutional Low-Odor/VOC Latex System, MPI INT 9.2M:
 - a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat, Ceilings: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), MPI #143.
 - d. Topcoat, Walls: Latex, interior, institutional low odor/VOC, eggshell (MPI Gloss Level 3), MPI #145.

- D. Concrete Substrates Traffic Surfaces:
 1. Water-Based Concrete Floor Sealer System MPI INT 3.2G:
 - a. First Coat: Sealer, water based, for concrete floors, matching topcoat.
 - b. Topcoat: Sealer, water based, for concrete floors, MPI #99.

- E. Concrete Masonry Substrates (CMU):
 1. Latex System, MPI INT 4.2A:
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, eggshell (MPI Gloss Level 3), MPI #52.

END OF SECTION 09 91 24

SECTION 10 14 00 - SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES.

- A. Dimensional Letters

1.2 RELATED REQUIREMENTS

- A. Section 26 51 00 - Interior Lighting: Exit signs required by code.

1.3 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 - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

1.4 SUBMITTALS

- A. See Section 01 30 00 - 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, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. 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.
 - 2. Submit for approval by Owner through Architect prior to fabrication.
- D. Samples: Submit one sample of each type of sign, of size similar to that required for project, illustrating sign style, colors, 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 60 00 - Product Requirements, for additional provisions.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Store tape adhesive at normal room temperature.

1.7 COORDINATION

- A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.
 - 1. For signs supported by or anchored to permanent construction, furnish templates for installation of anchorage devices.

1.8 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.
- C. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 APPEARANCE

- A. Verify all text on signage with Owner prior to production.

2.2 DIMENSIONAL LETTERS

- A. Metal Letters:
 - 1. Finish: $\frac{1}{4}$ " thick dimensional metal laminate letters with laminate sides to match.
 - 2. Laminate Color: As listed on drawings
 - 3. Mounting: Concealed per manufacturer.

2.3 ACCESSORIES

- A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

2.4 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

2.5 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 10 28 00 – TOILET, BATH AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Accessories for toilet rooms and utility rooms.
- C. Utility room accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Concealed supports for accessories, including in wall framing and plates.
- B. Section 09 30 00 - Tiling

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- F. ASTM C1036 - Standard Specification for Flat Glass; 2011.
- G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule.
- D. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Toilet Accessories: Products shall be as noted in drawings, or equivalent products by one of the following manufacturers:
 - 1. AJW Architectural Products
 - 2. American Specialties, Inc
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation
 - 5. General Accessory Manufacturing Co. (GAMCO)
 - 6. McKinney/ Parker Washroom Accessories Corp.
 - 7. Substitutions: Section 01 60 00 - Product Requirements.
- B. Provide products of each category type by single manufacturer.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
- B. Keys: Provide 4 keys for each accessory to Owner; master key lockable accessories.
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- F. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.
- G. Adhesive: Two component epoxy type, waterproof.
- H. Fasteners, Screws, and Bolts: Stainless Steel or Hot dip galvanized; tamper-proof; security type.
- I. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.
- C. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 COMMERCIAL TOILET ACCESSORIES

- A. See Toilet Accessory Schedule on the Drawings.

2.05 UTILITY ROOM ACCESSORIES

- A. Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, hat-shaped channel.
 - 1. Holders: 3 spring-loaded rubber cam holders.
 - 2. Length: Manufacturer's standard length for number of holders.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. Verify that field measurements are as indicated on drawings.
- D. See Section relevant specification sections for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

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SECTION 10 44 13 - FIRE PROTECTION CABINETS

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:
 - 1. Fire-protection cabinets for portable fire extinguishers.

1.3 PREINSTALLATION CONFERENCE

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For fire-protection cabinets.
- C. Samples: For each type of exposed finish required.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.

1. 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:
 - a. Activar Construction Products Group, Inc. - JL Industries.
 - b. Babcock-Davis.
 - c. Guardian Fire Equipment, Inc.
 - d. Larsens Manufacturing Company.

- B. Cabinet Construction: Nonrated and One-hour fire rated.
 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- thick cold-rolled steel sheet lined with minimum 5/8-inch- thick fire-barrier material. Provide factory-drilled mounting holes.

- C. Cabinet Material: Cold-rolled steel sheet.

- D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
 1. Rolled-Edge Trim: 2-1/2-inch backbend depth.

- E. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.

- F. Cabinet Trim Material: Steel sheet.

- G. Door Material: Steel sheet.

- H. Door Style: Fully glazed panel with frame.

- I. Door Glazing: Tempered float glass (clear).

- J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

- K. Accessories:
 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
 3. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
 4. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.

- a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

- 1) Location: Applied to cabinet door.
- 2) Application Process: Pressure-sensitive vinyl letters.
- 3) Lettering Color: Red.
- 4) Orientation: Vertical.

L. Materials:

- 1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
 - b. Color: White.
- 2. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.2 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.
- B. Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- C. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
- D. Identification: Apply vinyl lettering at locations indicated.
- E. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

END OF SECTION 10 44 13

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SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire extinguisher and mounting bracket indicated.
 - 1. 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:
 - a. Babcock-Davis.
 - b. Buckeye Fire Equipment Company.
 - c. Guardian Fire Equipment, Inc.
 - d. Larsens Manufacturing Company.
 - e. Nystrom.
 - 2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type: UL-rated 2.5-gal. nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: Top of fire extinguisher to be at 42 inches above finished floor.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16

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SECTION 14 24 00 - HYDRAULIC PASSENGER ELEVATORS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Hydraulic passenger elevators as shown and specified. Elevator work includes:
1. Standard pre-engineered hydraulic passenger elevators.
 2. Elevator car enclosures, hoistway entrances and signal equipment.
 3. Operation and control systems.
 4. Jack(s).
 5. Accessibility provisions for physically disabled persons.
 6. Equipment, machines, controls, systems and devices as required for safely operating the specified elevators at their rated speed and capacity.
 7. Materials and accessories as required to complete the elevator installation.
- B. Related Sections:
1. Division 1 General Requirements: Meet or exceed all referenced sustainability requirements.
 2. Division 3 Concrete: Installing inserts, sleeves and anchors in concrete.
 3. Division 4 Masonry: Installing inserts, sleeves and anchors in masonry.
 4. Division 5 Metals:
 - a. Providing hoist beams, pit ladders, steel framing, auxiliary support steel and divider beams for supporting guide-rail brackets.
 - b. Providing steel angle sill supports and grouting hoistway entrance sills and frames.
 5. Division 9 Finishes: Providing elevator car finish flooring and field painting unfinished and shop primed ferrous materials.
 6. Division 16 Sections:
 - a. Providing electrical service to elevators, including fused disconnect switches.
 - b. Emergency power supply, transfer switch and auxiliary contacts.
 - c. Heat and smoke sensing devices.
 - d. Convenience outlets and illumination in control room, hoistway and pit.
 7. Division 22 Plumbing
 - a. Sump pit and oil interceptor.
 8. Division 23 Heating, Ventilation and Air Conditioning
 - a. Heating and ventilating hoistways and/or control room.
- C. Work Not Included: General contractor shall provide the following in accordance with the requirements of the Model Building Code and ANSI A17.1 Code. For specific rules, refer to ANSI A17.1, Part 3 for hydraulic elevators. State or local requirements must be used if more stringent. The cost of this work is not included in the TK Elevator's proposal, since it is a part of the building construction.

1. Elevator hoist beam to be provided at top of elevator shaft. Beam must be able to accommodate proper loads and clearances for elevator installation and operation.
2. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.
3. Hatch walls require a minimum two hours of fire rating. Hoistway should be clear and plumb with variations not to exceed 1/2" at any point.
4. Elevator hoistways shall have barricades, as required.
5. Install bevel guards at 75° on all recesses, projections or setbacks over 2" (4" for A17.1-2000 areas) except for loading or unloading.
6. Provide rail bracket supports at pit, each floor and roof. For guide rail bracket supports, provide divider beams between hoistway at each floor and roof.
7. Pit floor shall be level and free of debris. Reinforce dry pit to sustain normal vertical forces from rails and buffers.
8. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending 42" minimum, (48" minimum for A17.1-2000 areas) shall be provided at the same height, above sill of access door or handgrips.
9. Machine room to be enclosed and protected.
10. Machine Room temperature must be maintained between 55° and 90° F.
11. If machine room is remote from the elevator hoistway, clear access must be available above the ceiling or metal/concrete raceways in floor for oil line and wiring duct from machine room.
12. Access to the machinery space and machine room must be in accordance with the governing authority or code.
13. Provide an 8" x 16" cutout through machine room wall, for oil line and wiring duct, coordinated with elevator contractor at the building site.
14. All wire and conduit should run remote from the hoistways.
15. When heat, smoke or combustion sensing devices are required, connect to elevator control cabinet terminals. Contacts on the sensors should be sided for 12 volt D.C.
16. Install and furnish finished flooring in elevator cab.
17. Finished floors and entrance walls are not to be constructed until after sills and door frames are in place. Consult elevator contractor for rough opening size. The general contractor shall supply the drywall framing so that the wall fire resistance rating is maintained, when drywall construction is used.
18. Where sheet rock or drywall construction is used for front walls, it shall be of sufficient strength to maintain the doors in true lateral alignment. Drywall contractor to coordinate with elevator contractor.
19. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.
20. To maintain legal fire rating (masonry construction), door frames are to be anchored to walls and properly grouted in place.

21. The elevator wall shall interface with the hoistway entrance assembly and be in strict compliance with the elevator contractor's requirements.
22. General Contractor shall fill and grout around entrances, as required.
23. Elevator sill supports shall be provided at each opening.
24. All walls and sill supports must be plumb where openings occur.
25. For applications with jack hole, free and clear access to the elevator pit area for the jack hole-drilling rig is required.
26. Where jack hole is required, remove all spoils from jack hole drilling.
27. When not provided by Elevator Contractor, jack hole shall accommodate the jack unit. If required the jack hole is to be provided in strict accordance with the elevator contractor's shop drawings.
28. Locate a light fixture (200 lx / 19 fc) and convenience outlet in pit with switch located adjacent to the access door.
29. A light switch and fused disconnect switch for each elevator should be located inside the machine room adjacent to the door, where practical, per the National Electrical Code (NFPA No. 70).
30. For signal systems and power operated door: provide ground and branch wiring circuits, including main line switch.
31. For car light and fan: provide a feeder and branch wiring circuits, including main line switch.
32. Wall thickness may increase when fixtures are mounted in drywall. These requirements must be coordinated between the general contractor and the elevator contractor.
33. Provide supports, patching and recesses to accommodate hall button boxes, signal fixtures, etc..
34. Locate telephone and convenience outlet on control panel.

1.02 SUBMITTALS

- A. Product data: When requested, the elevator contractor shall provide standard cab, entrance and signal fixture data to describe product for approval.
- B. Shop drawings:
 1. Show equipment arrangement in the corridor, pit, and hoistway and/or optional control room. Provide plans, elevations, sections and details of assembly, erection, anchorage, and equipment location.
 2. Indicate elevator system capacities, sizes, performances, safety features, finishes and other pertinent information.
 3. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.
 4. Indicate electrical power requirements and branch circuit protection device recommendations.

- C. Powder Coat paint selection: Submit manufacturer's standard selection charts for exposed finishes and materials.
- D. Plastic laminate selection: Submit manufacturer's standard selection charts for exposed finishes and materials.
- E. Metal Finishes: Upon request, standard metal samples provided.
- F. Operation and maintenance data. Include the following:
 - 1. Owner's manuals and wiring diagrams.
 - 2. Parts list, with recommended parts inventory.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: An approved manufacturer with minimum 15 years of experience in manufacturing, installing, and servicing elevators of the type required for the project.
 - 1. The manufacturer of machines, controllers, signal fixtures, door operators cabs, entrances, and all other major parts of elevator operating equipment.
 - a. The major parts of the elevator equipment shall be manufactured by the installing company, and not be an assembled system.
 - 2. The manufacturer shall have a documented, on-going quality assurance program.
 - 3. ISO-9001:2000 Manufacturer Certified
 - 4. ISO-14001:2004 Environmental Management System Certified
 - 5. LEED Gold certified elevator manufacturing facility.
- B. Installer Qualifications: The manufacturer or an authorized agent of the manufacturer with not less than 15 years of satisfactory experience installing elevators equal in character and performance to the project elevators.
- C. Regulatory Requirements:
 - 1. ASME A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.
 - 2. Building Code: National.
 - 3. NFPA 70 National Electrical Code.
 - 4. NFPA 80 Fire Doors and Windows.
 - 5. Americans with Disabilities Act - Accessibility Guidelines (ADAAG)
 - 6. Section 407 in ICC A17.1, when required by local authorities
 - 7. CAN/CSA C22.1 Canadian Electrical Code
 - 8. CAN/CSA B44 Safety Code for Elevators and Escalators.
 - 9. California Department of Public Health Standard Method V1.1–2010, CA Section 01350

D. Fire-rated entrance assemblies: Opening protective assemblies including frames, hardware, and operation shall comply with ASTM E2074, CAN4-S104 (ULC-S104), UL10(b), and NFPA Standard 80. Provide entrance assembly units bearing Class B or 1 1/2 hour label by a Nationally Recognized Testing Laboratory (2 hour label in Canada).

E. Inspection and testing:

1. Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
2. Arrange for inspections and make required tests.
3. Deliver to the Owner upon completion and acceptance of elevator work.

F. Sustainable Product Qualifications:

1. Environmental Product Declaration:
 - a. GOOD: If Product Category Rules (PCR) are not available, produce a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that has at least a cradle to gate scope.
 - b. BEST: If Product Category Rules (PCR) are available, produce and publish an Environmental Product Declaration (EPD) based on a critically reviewed life-cycle assessment conforming to ISO 14044, with external verification recognized by the EPD program operator.
2. Material Transparency:
 - a. GOOD: Provide Health Product Declaration at any level
 - b. BETTER: Provide Health Product Declaration (HPD v2 or later). Complete, published declaration with full disclosure of known hazards, prepared using the Health Product Declaration Collaborative's "HPD builder" on-line tool.
 - c. BEST: Cradle to Cradle Material Health Certificate v3, Bronze level or higher.
3. LEED v4 – Provide documentation for all Building Product Disclosure AND Optimization credits in LEED v4 for product specified.
4. Living Building Challenge Projects: Provide Declare label for products specified.

1.04 DELIVERY, STORAGE AND HANDLING

A. Manufacturing shall deliver elevator materials, components and equipment and the contractor is responsible to provide secure and safe storage on job site.

1.05 PROJECT CONDITIONS

A. Temporary Use: Elevators shall not be used for temporary service or for any other purpose during the construction period before Substantial Completion and acceptance by the purchaser unless agreed upon by Elevator Contractor and General Contractor with signed temporary agreement.

- B. Provide the hole for the jack unit (if required by the type of jack provided), based on excavation through normal soil or clay which can be removed by manual digging or by standard truck-mounted regular drilling unit. Provide a casing if required to retain the walls of the hole.

General contractor shall remove excavation spoils deposited in the elevator pit.

1. If a physical obstruction or hindrance is encountered below the ground surface, including boulders, rock, gravel, wood, metal, pilings, sand, water, quick sand, caves, public utilities or any other foreign material, obtain written authorization to proceed with excavating using special excavation equipment.
2. Maintain a daily log of time and material costs involved.
3. Elevator contractor will be compensated on a time and material basis for additional costs incurred after encountering the physical obstruction or hindrance, including the cost of the special excavation equipment.

1.06 WARRANTY

- A. Warranty: Submit elevator manufacturer's standard written warranty agreeing to repair, restore or replace defects in elevator work materials and workmanship not due to ordinary wear and tear or improper use or care for 12 months after final acceptance.

1.07 MAINTENANCE

- A. Furnish maintenance and call back service for a period of 12 months for each elevator after completion of installation or acceptance thereof by beneficial use, whichever is earlier, during normal working hours excluding callbacks.
 1. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies and parts to keep the elevators in proper operation. Maintenance work, including emergency call back repair service, shall be performed by trained employees of the elevator contractor during regular working hours.
 2. Submit parts catalog and show evidence of local parts inventory with complete list of recommended spare parts. Parts shall be produced by manufacturer of original equipment.
 3. Manufacturer shall have a service office and full time service personnel within a 100 mile radius of the project site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer: Design based around TK Elevator's endura hydraulic elevator.

2.02 MATERIALS, GENERAL

- A. All Elevator Cab materials including frame, buttons, lighting, wall and ceiling assembly, laminates and carpet shall have an EPD and an HPD, and shall meet the California Department of Public

Health Standard Method V1.1–2010, CA Section 01350 as mentioned in 1.03.9 of this specification.

B. Colors, patterns, and finishes: As selected by the Architect from manufacturer's full range of standard colors, patterns, and finishes.

C. Steel:

1. Shapes and bars: Carbon.
2. Sheet: Cold-rolled steel sheet, commercial quality, Class 1, matte finish.
3. Finish: Factory-applied baked enamel for structural parts, powder coat for architectural parts. Color selection must be based on elevator manufacture's standard selections.

D. Plastic laminate: Decorative high-pressure type, complying with NEMA LD3, Type GP-50 General Purpose Grade, nominal 0.050" thickness. Laminate selection must be based on elevator manufacture's standard selections.

E. Flooring by others.

2.03 HOISTWAY EQUIPMENT

A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood sub-floor. Underside of the platform shall be fireproofed. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25% of the rated capacity.

B. Sling: Steel stiles bolted or welded to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.

C. Guide Rails: Steel, omega shaped, fastened to the building structure with steel brackets.

D. Guides: Slide guides shall be mounted on top and bottom of the car.

E. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor. Provide extensions if required by project conditions.

F. Jack: A jack unit shall be of sufficient size to lift the gross load the height specified. Factory test jack to ensure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Provide the following jack type: Twin post holeless. Two jacks piped together, mounted one on each side of the car with a polished steel hydraulic plunger housed in a sealed steel casing having sufficient clearance space to allow for alignment during installation. Each plunger shall have a high pressure sealing system which will not allow for seal movement or displacement during the course of operation. Each Jack Assembly shall

have a check valve built into the assembly to allow for automatically re-syncing the two plunger sections by moving the jack to its fully contracted position. The jack shall be designed to be mounted on the pit floor or in a recess in the pit floor. Each jack section shall have a bleeder valve to discharge any air trapped in the section..

- G. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for over travel or under travel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.
- H. Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the National Electrical Code. All necessary code compliant pipe and fittings shall be provided to connect the power unit to the jack unit. Provide proper grade inherently biodegradable oil as specified by the manufacturer of the power unit (see Power Unit section 2.04.G for further details)

2.04 POWER UNIT

- A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit consisting of the following items:
 - 1. An oil reservoir with tank cover.
 - 2. An oil hydraulic pump.
 - 3. An electric motor.
 - 4. An oil control valve with the following components built into single housing; high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and electro-magnetic controlling solenoids.
- B. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.
- C. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating shall be selected for specified speed and load.
- D. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.
 - 1. Relief valve shall be adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.

2. Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
3. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
4. Lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.
5. Solid State Starting: Provide an electronic starter featuring adjustable starting currents.
6. Oil Type: Provide a zinc free, inherently biodegradable lubricant formulated with premium base stocks to provide outstanding protection for demanding hydraulic systems, especially those operating in environmentally sensitive areas.

2.05 HOISTWAY ENTRANCES

- A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening bolted\knock down construction.
 1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates (where required), sight guards, and necessary hardware.
 2. Main landing door & frame finish: ASTM A1008 steel panels, factory applied powder coat finish with factory-applied powder coat finish entrance frame.
 3. Typical door & frame finish: ASTM A366 steel panels, factory applied powder coat enamel finish with factory-applied powder coat finish entrance frame.
- B. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.
- C. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.
 1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
 2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
 3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.
- D. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum.

2.06 PASSENGER ELEVATOR CAR ENCLOSURE

- A. Car Enclosure:

1. Walls: Cab type TKAP, reinforced cold-rolled steel with two coats factory applied baked enamel finish, with applied vertical wood core panels covered on both sides with high pressure plastic laminate.
 2. Reveals and frieze: a. Reveals and frieze: Stainless steel, no. 4 brushed finish
 3. Canopy: Cold-rolled steel with hinged exit.
 4. Ceiling: Downlight type, metal pans with suspended LED downlights and dimmer switch. Number of downlights shall be dependent on platform size with a minimum of six. The metal pans shall be finished with a stainless steel, no. 4 brushed finish.
 5. Cab Fronts, Return, Transom, Soffit and Strike: Provide panels faced with brushed stainless steel
 6. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.
 - a. Door Finish: Stainless steel panels: No. 4 brushed finish.
 - b. Cab Sills: Extruded aluminum, mill finish.
 7. Handrail: Provide 2' flat metal bar on side and rear walls on front opening cars and side walls only on front and rear opening cars. Handrails shall have a stainless steel, no. 4 brushed finish.
 8. Ventilation: Manufacturer's standard exhaust fan, mounted on the car top.
 9. Protection pads and buttons: Not required
- B. Car Top Inspection: Provide a car top inspection station with an "Auto-Inspection" switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operating devices inoperative. The station shall give the inspector complete control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

2.07 DOOR OPERATION

- A. Door Operation: Provide a direct or alternating current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. The door control system shall be digital closed loop and the closed loop circuit shall give constant feedback on the position and velocity of the elevator door. The motor torque shall be constantly adjusted to maintain the correct door speed based on its position and load. All adjustments and setup shall be through the computer based service tool. Door movements shall follow a field programmable speed pattern with smooth acceleration and deceleration at the ends of travel. The mechanical door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. AC controlled units with oil checks, or other deviations are not acceptable.

1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.
 2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
 3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches of fully closed, the travel shall reverse and the door shall reopen to answer the other call.
 4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer shall sound. When the obstruction is removed, the door shall begin to close at reduced speed. If the infra-red door protection system detects a person or object while closing on nudging, the doors shall stop and resume closing only after the obstruction has been removed.
 5. Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors shall reverse and reopen. After the obstruction is cleared, the doors shall begin to close.
 6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors shall recycle closed then attempt to open six times to try and correct the fault.
 7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors shall recycle open then attempt to close six times to try and correct the fault.
 8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.
- B. Door Protection Device: Provide a door protection system using microprocessor controlled infra-red light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

2.08 CAR OPERATING STATION

- A. Car Operating Station, General: The main car control in each car shall contain the devices required for specific operation mounted in an integral swing return panel requiring no applied faceplate. Wrap return shall have a brushed stainless steel finish. The main car operating panel shall be mounted in the return and comply with handicap requirements. Pushbuttons that illuminate using long lasting LED's shall be included for each floor served, and emergency

buttons and switches shall be provided per code. Switches for car light and accessories shall be provided.

- B. Emergency Communications System: Integral phone system provided.
- C. Auxiliary Operating Panel: Not Required
- D. Column Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the door(s) begin to close.
- E. Special Equipment: Not Applicable

2.09 CONTROL SYSTEMS

- A. Controller: The elevator control system shall be microprocessor based and software oriented. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.
- B. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.
- C. Emergency Power Operation: (10-DOA) Upon loss of the normal power supply, building-supplied standby power is available on the same wires as the normal power supply. Once the loss of normal power is detected and standby power is available, the elevator is lowered to a pre-designated landing and the doors are opened. After passengers have exited the elevator, the doors are closed and the car is shut down. When normal power is restored, the elevator automatically resumes operation.
- D. Special Operation: Not Applicable

2.10 HALL STATIONS

- A. Hall Stations, General: Buttons shall illuminate to indicate call has been registered at that floor for the indicated direction.
 - 1. Provide one pushbutton riser with faceplates having a brushed stainless steel finish.
 - a. Phase 1 firefighter's service key switch, with instructions, shall be incorporated into the hall station at the designated level.

- B. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.
- C. Hall Position Indicator: Not Applicable
- D. Hall lanterns: Not Applicable
- E. Special Equipment: Not Applicable

2.11 MISCELLANEOUS ELEVATOR COMPONENTS

- A. Oil Hydraulic Silencer: Install multiple oil hydraulic silencers (muffler device) at the power unit location. The silencers shall contain pulsation absorbing material inserted in a blowout proof housing.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Before starting elevator installation, inspect hoistway, hoistway openings, pits and/or control room, as constructed, verify all critical dimensions, and examine supporting structures and all other conditions under which elevator work is to be installed. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.
- B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 INSTALLATION

- A. Install elevator systems components and coordinate installation of hoistway wall construction.
 - 1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
 - 2. Comply with the National Electrical Code for electrical work required during installation.
- B. Jack unit excavation (if required by the type of jack provided): Drill or otherwise excavate below elevator pit construction as required to install the jack unit.
 - 1. Install casing for jack unit.
 - 2. Provide HDPE jack protection system for all in ground jacks.

3. Set casing for jack unit assembly plumb, and partially fill with water set-tled sand, eliminating voids. Back fill depth shall be sufficient to hold the bottom of the jack in place over time.
- C. Perform work with competent, skilled workmen under the direct control and supervision of the elevator manufacturer's experienced foreman.
 - D. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports, and bracing including all setting templates and diagrams for placement.
 - E. Welded construction: Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualification of welding operators.
 - F. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.
 - G. Install machinery, guides, controls, car and all equipment and accessories to provide a quiet, smoothly operating installation, free from side sway, oscillation or vibration.
 - H. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing.
 - I. Erect hoistway sills, headers, and frames before erection of rough walls and doors; erect fascia and toe guards after rough walls finished. Set sill units accurately aligned and slightly above finish floor at landings.
 - J. Lubricate operating parts of system, where recommended by manufacturer.

3.03 FIELD QUALITY CONTROL

- A. Acceptance testing: Upon completion of the elevator installation and before permitting use of elevator, perform acceptance tests as required and recommended by Code and governing regulations or agencies. Perform other tests, if any, as required by governing regulations or agencies.

- B. Advise Owner, Contractor, Architect, and governing authorities in advance of dates and times tests are to be performed on the elevator.

3.04 ADJUSTING

- A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

3.05 CLEANING

- A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided. Stainless steel shall be cleaned with soap and water and dried with a non-abrasive surface; it shall not be cleaned with bleach-based cleansers.
- B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.
 - 1. Use environmentally preferable and low VOC emitting cleaners for each application type. Cleaners that contain solvents, pine and/or citrus oils are not permitted.

3.06 PROTECTION

- A. At time of Substantial Completion of elevator work, or portion thereof, provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

3.07 DEMONSTRATION

- A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.
- B. Make a final check of each elevator operation, with Owner's personnel present, immediately before date of substantial completion. Determine that control systems and operating devices are functioning properly.

3.08 ELEVATOR SCHEDULE

A. Elevator Qty. 1

1. Elevator Model: endura Twinpost above-ground 1-stage
2. Elevator Type: Hydraulic Passenger
3. Rated Capacity: 3000 lbs.
4. Rated Speed: 80 ft./min.
5. Operation System: TAC32H
6. Travel: 14'-0"
7. Landings: 2 total
8. Openings:
 - a. Front: 2
 - b. Rear: 0
9. Clear Car Inside: 6'-8" wide x 4'-9" deep
10. Inside clear height: 8'-4" standard
11. Door clear height: 7'-0" standard
12. Hoistway Entrance Size: 3'-6" wide x 7'-0" high
13. Door Type: One-speed Center opening
14. Power Characteristics: 460 volts, 3 Phase, 60 Hz.
15. Seismic Requirements: Zone
16. Hoistway Dimensions: 8'-4" wide x 6'-3" deep
17. Pit Depth: 4'-0"
18. Button & Fixture Style: Traditional Signal Fixtures
19. Special Operations: None

3.09 SPECIAL CONDITIONS (Note: Add Special Conditions as Needed)

END OF SECTION

SECTION 21 00 00 - FIRE SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, tools, and equipment, and perform all work and services necessary for or incidental to the complete installation of a fire protection system which shall be completely coordinated with the work of all other trades. All work shall be performed by an automatic sprinkler contractor licensed in the State of Florida who shall certify the complete installation.
- B. Although such work is not specifically shown or specified, all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a complete and operable installation shall be furnished and installed as part of this work.
- C. The subcontractor for the fire sprinkler system shall include in the cost of the work, detail sprinkler system drawings, custom designed to the actual field conditions and the installation shall exactly match the drawings prepared. Such sprinkler system design shall incorporate features to cause maximum insurance rating benefit to the Owner.
- D. Fire protection contractor shall have sprinkler plans and specifications signed and sealed by an engineer registered in the State of Florida and submit them for permitting.
- E. Reference Specification 23 05 00 – General Requirements for Mechanical Work for additional requirements.

1.2 DESCRIPTION OF WORK

- A. Work included in this section of the specifications shall consist generally of, but is not limited to, the following major systems or categories of work: The work includes the hydraulic design and installation of an automatic wet pipe fire extinguishing sprinkler system for the entire building. Wet pipe protection shall be provided for all spaces beneath the ceilings. The design, equipment, materials, installation and workmanship shall be in strict accordance with the required and advisory provisions of NFPA 13 (2016), except as modified herein. System shall include all materials, accessories, and equipment necessary to provide an automatic system which is complete and ready to use. Design and install system to give full consideration to lighting blind spaces, piping, electrical equipment, ductwork, and all other construction and equipment to afford complete coverage in accordance with prevailing code requirements. Devices and equipment for fire protection service shall be of an approved make and type listed by the Underwriters' Laboratories, Inc., or approved by the Factory Mutual System.

1.3 SPRINKLER CODES AND STANDARDS

- A. Entire system shall be installed in accordance with the following codes and standards for the occupancy hazards as hereinbefore specified.

- B. Standards of the National Fire Protection Association: Sprinkler Systems No. 13 (2016).
- C. A new fire service main including excavation and connection where indicated.
- D. Any special requirements of the building's Insurance Underwriter or IRA.
- E. Requirements of the fire inspection bureau having jurisdiction.
- F. Florida Building Code (2020).

1.4 INSTALLATION

- A. Furnish and install a complete fire protection system in accordance with this specification and as required by state and local governing codes.
- B. System shall consist of connection to water service, valves, piping, underground piping to sprinkler system. Provide sleeves at all floor and wall penetrations.
- C. The Contractor shall conduct a flow test to insure available flow and pressure at point of connection.
- D. Unless otherwise noted, the system classification shall be for light hazard occupancy to protect the facility. Should particular areas of the facility be classified other than as indicated coordinate with Engineer.

1.5 SUBMITTALS

- A. Submit a 1/8" = 1'-0" minimum scale reproducible shop drawing in accordance with NFPA #13 to the Architect. The Architect will forward copies to the Owner's insurance underwriter for approval and/or comments. Verify all clearances, lighting fixtures, piping, etc., at job site or from contract documents.
- B. Approval by Architect will be for general location only. Approval by insurance carrier will be for specific recommendations which shall be strictly adhered to. Where there is conflict between authority's recommendations and these drawings and specifications, recommendations by the authority shall govern.
- C. Submit to Architect for approval actual photographs or samples of all items of equipment which will be visible with the finished work. Include such items as siamese connections, valves, flow switches, sprinkler heads, etc.

PART 2 - PRODUCTS

2.1 MATERIALS SPECIFICATIONS

- A. All material and equipment shall be furnished by an established and reputable manufacturer.

All material and equipment shall be new, unused, and of first class construction designed and guaranteed to perform the service required and shall be approved by NFPA and UL.

- B. Above grade piping shall be black steel, Schedule 10 for sizes 2-1/2" and larger; ASTM A135. Fittings shall be UL and FM approved mechanical couplings. Piping 2" and smaller shall be Schedule 40 black steel with 175 lb. screw pattern fittings. Provide thrust restraints where steel piping is connected to cast iron.
- C. All piping exposed to view shall be painted before final acceptance by Owner. Remove all rust, scale, dirt, etc., and prime and finish with red pipeline enamel.

2.2 PIPE HANGERS

- A. Pipe hangers shall be spaced in accordance with requirements of NFPA. Hangers, hanger rods, inserts and clamps shall be constructed as approved by same and have zinc or galvanized coating. Hangers shall be same type as specified in plumbing section.

2.3 DRAINS

- A. Install approved drains at low points of all piping and elsewhere as required to permit complete drainage of system without disconnection of any piping. Drain and test connections on end of sprinkler branches shall be piped to exterior of building. Coordinate drain location at exterior of building with architect.

2.4 VALVES

- A. Only approved OS&Y as required by Underwriters' Laboratories and NFPA shall be used. Check valves shall be approved by NFPA. Test and drain valves and hangers shall be approved and shall conform to requirements of NFPA. All OS&Y valves used in fire protection system shall have provisions for padlocking and tamper switches. (Tamper switches shall be furnished and installed by the fire protection contractor and wired by the electrical contractor. Fire protection contractor shall coordinate power requirements of tamper switches with Electrical Engineer.)

2.5 BALL DRIP

- A. Install ball drips at each location shown on plans or where required. Ball drips to be 1/2" size, Elkhart No. 701 or equal.

2.6 SIAMESE CONNECTIONS

- A. Provide and install a two-way remote siamese connection with a 4" x 2-1/2" x 2-1/2" angle body. On face of siamese shall be written the words "Automatic Sprinkler". Automatic ball drip and check valve shall be UL and NFPA pamphlet No. 14 approved. Threads on each siamese shall meet local fire department requirements. Provide brass plugs and chain with en-

tire assembly chrome plated finish. Unit shall be Elkhert with dependent drop clapper valves. Acceptable manufacturers shall be Potter-Roemer and Croker-Standard.

- B. Coordinate use of Siamese connection as remote mounted type units subject to location of access roads. Free standing units shall be chrome plated.
- C. Coordinate final location of Siamese with civil contractor to ensure a fire hydrant is within 80 feet of Siamese.

2.7 SPRINKLER HEADS

- A. Install all sprinkler heads as required by NFPA No. 13. Heads shall be rated for various temperatures and flows as determined by National Fire Protection Association. In no case shall they be rated at more than 155°F.
- B. Furnish spare sprinkler heads and wrench as required by NFPA and place in metal cabinet on job site where directed by Architect.
- C. All sprinkler heads shall be of type and operating temperature as required by specific location of installation.
- D. Sprinkler heads in general areas shall be semi-recessed, quick-response type with chrome finish.
- E. Sprinkler heads in areas without ceilings shall be upright with wire guards.

2.8 SPACE LIMITATIONS

- A. Route piping to avoid interferences with ducts, piping, lighting, etc. Necessary offsets, crossover or other routing shall be provided to permit all systems to be installed in available space. Offsets, crossovers, etc., are not shown on drawings. Investigate mechanical, electrical, and architectural drawings to ascertain how work of other trades affect installation.

2.9 FLOW SWITCHES

- A. Install UL approved flow switches and alarm devices where shown or required. Flow switches shall be Autocall, Notifier with electrical rating for pilot duty only. Switches shall be suitable for working pressures of 150 psi with adjusting screw to provide sensitivity. Wiring from flow switches to fire alarm system provided under another section. Coordinate power requirements and points of connection with electrical contractor. Switch shall have contacts required for interconnection to the fire alarm system.

2.10 BACKFLOW PREVENTER

- A. Backflow preventer shall be of the double check type assembly supplied and installed by the site utility contractor. See Civil plans for location.

PART 3 - EXECUTION

3.1 TESTS AND INSPECTION

- A. Work included herein shall include all tests and inspections by State authority and/or local Fire Marshall and all permits or inspection fees connected therewith. At completion of work and prior to acceptance by Owner, demonstrate complete operation of system including alarms.

3.2 DRAWINGS

- A. Drawings are diagrammatic. Field route all piping on job site. All piping in finished spaces shall be run concealed.

3.3 COORDINATION

- A. Sprinkler contractor shall coordinate with utility the requirements of pressure and water supply for satisfactory operation of this system.

END OF SECTION 21 00 00

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SECTION 22 00 50 - PLUMBING

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 RELATED DOCUMENTS

- A. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 1 specification sections apply to work specified in this section.
- B. Reference Section 23 05 00 “General Requirements for Mechanical Work” for contractor qualifications.

1.3 SCOPE OF WORK

- A. These specifications and the accompanying drawings are intended to provide for all labor and materials necessary for the installation of complete workable systems as specified herein or indicated on the drawings. The work required under this section of the specification shall include specifically, but is not limited to the following:
 - 1. A system of potable cold water piping for domestic use including connections to plumbing fixtures and equipment as shown or indicated on the drawings.
 - 2. A system of potable hot water piping for domestic use including connections to plumbing fixtures and equipment as shown or indicated on the drawings.
 - 3. A system of sanitary soil, waste, and vent piping including connections to fixtures and equipment as shown or indicated on the drawings.

1.4 CODES AND REGULATIONS

- A. All work performed under this section shall conform with all local governing regulations, and in case of conflicting requirements, the most stringent shall apply. Minimum requirements shall be the International Plumbing Code as published by the International Code Council.
- B. Should it be found that any part of the work shown or specified is not in accordance with local regulations, the Architect shall be so advised at the time of bidding and all work installed as required to meet the local codes.
- C. The Contractor shall comply with the latest revisions of all county, district, municipal, or local building codes, interpretations, buildings permits to include but not be limited to:

1. Florida Building Code – 2020 with all supplements
2. Florida Mechanical Code – 2020 with all supplements
3. Florida Plumbing Code – 2020 with all supplements

1.5 FEES AND PERMITS

- A. The Contractor shall obtain and pay for all permits, fees for inspection, and charges of every kind that may be necessary for fully completing the work. He shall make all necessary tests required by the City, County or State authorities, legal regulations and/or the Architect, and return to the Architect any certificates of approval issued in this district for plumbing work, etc., signed by the inspector in charge of each particular part of the work.

1.6 DEVIATIONS

- A. No deviations from the drawings and specifications shall be made without full knowledge and consent of the Architect. No backfilling of trenches will be permitted until as-built drawings are approved as up-to-date by the Architect.

1.7 COOPERATION

- A. The Contractor shall lay out and proceed with his work so that this work will be executed in harmony with all other contractors and trades on the job.

1.8 VISITING THE PREMISES

- A. The Contractor, before submitting his bid on the work, must visit the site and familiarize himself with all existing conditions. As a result of having visited the premises, the Contractor shall be responsible for the installation of the work as it relates to such existing conditions. The submission of a bid will be considered an acknowledgment on the part of the bidder of his visitation to the site.

1.9 VERIFICATION OF CONTRACT DRAWINGS

- A. The drawings and specifications are intended to cooperate. Any materials, equipment, or systems related to this section and exhibited on the architectural and plumbing drawings, but not mentioned in the specifications are to be executed to the intent and meaning thereof, as if it were both mentioned in the specification and set forth on the drawings. Where the Contractor finds the specification and/or drawings to be in conflict or where they are not clear, same shall be brought to the attention of the Architect prior to submitting a bid.
- B. The plans indicate the general arrangement of the utilities. The locations of piping are approximate for clarity. Exact locations shall be determined in the field by the Contractor. In the event it should become necessary to change the locations of any work due to building construction, etc., the Contractor shall secure the approval of the Architect before making the changes. Any changes approved by the Architect shall be made without added cost to the

Owner. Under no circumstances shall the sizes indicated on the drawings be changed without securing written approval of the Architect.

- C. The drawings are diagrammatic and do not necessarily show or indicate all fittings, offsets, and accessories which may be required. The Contractor shall carefully investigate the structural and finish conditions affecting all his work as well as the operational requirements of each system and shall arrange such work accordingly, furnishing such fittings, etc., as may be required for the proper and efficient functioning of each system. No unnecessary or unauthorized offsets will be permitted.

1.10 WORKMANSHIP

- A. All workmanship performed under this section shall be executed in a first class manner in accordance with the best practices of the trade. The Architect reserves the right to accept or reject workmanship and determine when the Contractor has complied with the requirements herein specified. Only competent mechanics skilled in their respective trades shall be employed by the Contractor.

1.11 RESPONSIBILITY OF BIDDER

- A. The failure or omission of any bidder to receive or examine any form, instrument, addendum or other document shall in no way relieve any bidder from any obligation with respect to his bid or the contract. The submission of a bid shall be taken as prima facia evidence of compliance with this paragraph and that he has included in his proposal every item of cost necessary for a complete installation of the plumbing systems as drawn and/or specified.

1.12 NOISE AND VIBRATION

- A. This Contractor shall be held responsible for elimination of all noises or vibrations transmitted to occupied areas from equipment which he may install. This applies particularly to vibration and noises in piping, water hammer, and vibration from mechanical equipment transmitted through bases to building structure. He shall furnish and install anti-vibration bases, flexible connectors for piping, etc., as may be necessary.

1.13 SUBMITTAL DATA

- A. Materials and equipment schedules shall be submitted as soon as practicable, but not later than 30 days after the date of award of contract, and before commencement of installation of any material or equipment. A complete schedule of the material and equipment proposed for installation shall be submitted in proper binders (3-ring or fastener type), for approval by the Architect. The schedule shall include catalogs, cuts, diagrams, drawings, specifications and such other descriptive data as may be required by the Architect. Each item submitted shall be marked with the same identifying tag number indicated on the construction documents. The schedule and supplementary data shall be submitted in six (6) copies, and approval obtained. All materials required to be submitted for approval under this section shall be submitted at one time.

- B. Partial submittals will not be considered. Each item submitted shall be identified by its applicable drawing number.
- C. Where equipment named as equivalent or approved equal are proposed for use by the Contractor, he shall be responsible for coordinating any changes with all trades affected.
- D. The following equipment and material shall be submitted for approval:
 - 1. Valves
 - 2. Cleanouts
 - 3. Access Panels
 - 4. Insulation
 - 5. Water Heater and Mixing Valves
 - 6. Plumbing fixtures, including Traps, Supplies, and Carriers
 - 7. Floor Drains
 - 8. Trap Primers
 - 9. Water Hammer Arrestors
 - 10. Hose Bibbs and Wall Hydrants
 - 11. Valve Boxes
 - 12. Piping Materials and Fittings

1.14 START-UP SERVICE

- A. The Contractor shall put all items installed under this section into operation and shall instruct the Owner's maintenance personnel in all points requiring service and maintenance. Further, the Contractor shall make all adjustments and/or service requirements to said equipment during the first 60 days of actual occupancy.

1.15 MAINTENANCE DATA

- A. Operational, maintenance, and spare parts booklets shall be provided for all items of equipment requiring maintenance. Provide a minimum of three (3) copies and turn over to Architect. Bind in vinyl covered three-ring binders.

1.16 GUARANTEE

- A. All materials and equipment provided and/or installed under this section of the specifications shall be guaranteed for a period of one year from date of acceptance of the work by the Architect. Should any trouble develop during this period due to defective materials or faulty workmanship, the Contractor shall furnish all necessary labor and materials to correct the trouble without any cost to the Owner. Any defective materials or inferior workmanship noticed at time of installation and/or during the guarantee period shall be corrected immediately to the entire satisfaction of the Architect.

PART 2 – PRODUCTS

2.1 SOIL, WASTE, AND VENT SYSTEMS

- A. Below grade waste, vent, sewer shall be Schedule 40 drain and vent pipe and fittings shall be manufactured from PVC compound with a cell class of 12454 per ASTM D 1784 and conform with National Sanitation Foundation (NSF) standard 14. Pipe shall be iron pipe size (IPS) conforming to ASTM D 1785 and ASTM D 2665. Injection molded fittings shall conform to ASTM D 2665. Fabricated fittings shall conform to ASTM F 1866.
- B. Above grade waste, vent, and sewer lines shall be no-hub service weight cast iron soil pipe and fittings and shall conform to the requirements of CISPI Standard 301, ASTM A 888, or ASTM A 74 for all pipe and fittings. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute or receive prior approval of the engineer.
- C. All PVC pipe and fittings to be produced by a single manufacturer and to be installed in accordance with manufacturer's recommendations and local code requirements. Solvent cements shall conform to ASTM D 2564. Primer shall conform to ASTM F 656.
- D. Exposed piping and piping installed in return air plenums and rated assemblies shall be no-hub, cast-iron pipe and fittings installed in strict accordance with manufacturer's printed instructions.
- E. Where pipes pass through fire walls, fire partitions, or fire rated floors, an approved UL Fire Seal shall be provided. System employed shall be assigned an approval number in accordance with the latest Fire Resistance Directory published by Underwriters' Laboratories.
- F. Couplings for no-hub pipe and fittings shall conform to the manufacturer's installation instructions and ASTM Standard C-564.
- G. All cast iron pipe shall bear the NSF Seal of Approval, and such other markings as required by the aforementioned standards.
- H. Fixture runouts shall be DWV copper or brass piping with screwed or sweat joints respectively, with drainage pattern fittings.
- I. Unions will not be permissible in soil, waste, or vent piping.
- J. Test fittings required for system test are not shown on the drawings, but shall be provided by the Contractor where required.
- K. Grading: Minimum grade for soil pipe shall be as follows:
 - 1. For 2-inch pipe, grade shall be 1/4-inch per foot (minimum).
 - 2. For 3, 4 & 6 inch pipe, grade shall be 1/8-inch per foot (minimum).
- L. Vent Pipes:

1. Main soil pipe stacks to be extended up through the building full size with increaser through roof per code.
2. Connect branch vents into main stacks with connections not less than 4 feet above the highest fixture.
3. All vent stacks shall be connected at the bottom to main drainage system and all horizontal runs shall be graded so as to discharge all water or condensation.
4. Vents from any fixture, when connected to vent serving other fixtures, shall be extended at least 6" above flood level rim of height of such fixtures to prevent use of vent lines as a waste.

2.2 DOMESTIC (POTABLE) WATER PIPING

- A. Type "L" copper tubing shall be used for all above grade piping and type "K" copper tubing shall be used for all below slab piping. Sweat fittings shall be either cast brass or wrought copper. Solder joints shall be cleaned with steel wool or emery cloth before applying soldering paste (flux) using lead-free solder for domestic water tubing. No other type of solder shall be used. No joints below floor slabs will be permitted. Copper pipe shall not come in direct contact with concrete or masonry materials. Reference specification section 'sleeves'.
- B. Grading: Pipe shall be graded upward from source to facilitate draining. Where low points are required because of long runs or where sections may be valved off, the low point will be provided with 3/4-inch globe valve and hose nipple for draining.
- C. Nipples: Of same materials as pipe in which they are installed; provide extra strong when unthreaded portion is less than 1" long.
- D. Shock Absorbers: Install Zurn Shocktrols or equal manufactured shockstops, PDI rated as indicated on drawings. Provide access door to all shockstops installed in concealed areas.
- E. All fittings on copper pipe shall be copper. The pipe and fittings shall be thoroughly cleaned before inserting into the joint and then soldered with lead free solder.
- F. Utility Connection: Utility Contractor will provide a connection to the water main and will connect to building water runouts as shown. Coordinate stub from building with utility drawings.
- G. Water Pressure: Supply system is designed for static pressure of 50 to 60 PSI. Gauge water supply adjacent to building to verify that pressure is within those limits. Submit report in writing.

2.4 DRAINAGE SPECIALTIES

- A. Cleanouts: Provide accessible cleanouts at the foot of each soil and waste stack. Cleanouts shall be placed as per the Florida Building Code – Plumbing. Cleanouts shall be as manufactured by Smith, Josam, Zurn or approved equal.

B. Provide in sanitary piping at all changes in direction, at ends of branches, at intervals not exceeding 100' on straight runs, and elsewhere as shown. Cleanouts shall be full opening type completely accessible. Size same as lines in which they occur, but not larger than 4". Tees and extensions shall be of same weight as pipe. Plugs shall be countersunk PVC type.

1. In outside line, use 4280 "Smith" duco cast iron cleanout ferrule with countersunk PVC closure plug. Terminate flush with grade or pavement in concrete pad with tooled edges. Reference plumbing drawings for concrete pad details.
2. In finished walls, use cast iron cleanout tee fitting with PVC closure plug and stainless steel wall plate cover. Where distance from plug to finish wall will exceed 4", provide extended cover from sanitary tee to bring plug within 4".
3. In quarry tile floors, use 4180 duco cast iron cleanout with PVC closure plug and round adjustable secured nickel bronze top with 1/2" recess.
4. In carpeted floors, install under carpet. Do not cut carpet. Provide carpet marker for cleanout location.
5. In tile floors, use 4040 duco cast iron cleanout with square adjustable scoriated nickel bronze top; where soft tile occurs, provide 4160 with recessed square nickel bronze cover.
6. In concrete floors, use 4240 duco cast iron cleanout with round adjustable scoriated cast iron top with a loose set, non-tilt tractor cover.

C. Floor Drains and Floor Sinks: Size outlets same as pipe to which they connect. Install temporary closures during construction. Provide type as scheduled below.

1. Floor drains shall be square type equal to Zurn ZN-415 Series with nickel bronze top and flashing collar. Floor drains shall be provided with trap primer tap as indicated on plans. Provide with square grates in lieu of round grates.
2. Floor Sinks: 8"x8" floor sinks shall be equal to Zurn Z-1910 with 8"x8"x6" sump, inlet dome strainer and 1/2 top grate.
3. Floor Sinks: 12"x12" floor sinks shall be equal to Zurn Z1901 with 12"x12"x8" sump, inlet dome strainer and 3/4 top grate.

2.5 SLEEVES

A. All domestic water copper tubing and piping run below slab on grade or encased on concrete shall be sleeved with 27 mil flexible pipe protector for entire encased run and extending 6" beyond concealment. All pipes passing through masonry or concrete construction shall be fitted with sleeves. Sleeves in bearing walls, floors, and/or beams shall be made of Schedule 40 galvanized steel pipe. Sleeves in other masonry walls or core-drilled openings shall be 26 gage metal, PVC, or other approved material. Each sleeve shall extend through its respective wall, and shall be cut flush with each surface unless otherwise specified. Sleeves shall be two pipe sizes large in diameter than the passing pipe when uncovered, and one pipe size larger than the overall outside diameter of the covering when the passing pipe is insulated. Space between all floor sleeves and passing pipes shall be made watertight by caulking with approved rope packing and plastic waterproof caulking compound as approved by the Architect. All sleeves shall be properly installed and securely cemented in place. All sleeves through floor or above grade in equipment space shall extend 1-inch above finished floor.

2.6 FLOOR, WALL, AND CEILING PLATES

- A. All pipes passing through the floors, walls, or ceilings of finished rooms shall be fitted with brass chrome plated floor, wall or ceiling plates, securely fastened in place by set screw. Plates shall be large enough to accommodate the piping, pipe insulation and completely conceal the wall opening around the penetrating pipe including wall sleeve. Wall and floor plates shall be of the deep pattern type where required.

2.7 HANGERS, CLAMPS, AND SUPPORTS

- A. Piping shall be supported by hangers and clamps. When secured to concrete or masonry, concrete inserts or expansion type devices approved and recommended for the application shall be used. The use of explosive anchoring devices is prohibited. Hangers and clamps shall be of similar material as piping or coated as required to prevent bimetallic electrolytic action. Hangers and clamps exposed to exterior conditions shall be stainless steel.
- B. Hangers shall be adjustable "split ring and bolt" type or "clevis" type. Hangers for insulated pipe shall be of size to allow pipe covering to pass through the hanger without crushing. Where pipe covering passes through the hanger, the covering shall be protected with rib-lock Insu-Shield pipe saddles as manufactured by Insul-Coustic Corporation, Elcen Iso-Shields, or approved equal.
- C. All hangers of one type shall be catalog items of one manufacturer.
- D. No plumbers strap shall be used.
- E. When hanger rods are over 18 inches in length, provide lateral bracing every fourth hanger.
- F. Hanger Spacing Schedule:
 - 1. General: Spacing is indicated in maximum distances based on pipe materials and sizes. Closer spacing shall be provided to conform to structural spacing and load capacity of structural support points.
 - 2. Cast Iron Pipe:
 - 5 ft. lengths – maximum 5 ft. on centers.
 - 10 ft. lengths – maximum 8 ft. on centers.
 - 3. Copper Pipe:
 - Up to 1-1/4" – maximum 5 ft. on centers.
 - 1-1/2" to 4" – maximum 8 ft. on centers.
 - 4. Steel Pipe:
 - Up to 1-1/2" – maximum 7 ft. on centers.
 - 2" to 4" – maximum 10 ft. on centers.
 - 5" to 8" – maximum 16 ft. one centers.
 - 5. Vertical Pipe: Same as horizontal spacing. Use riser clamps at upper floor slabs to support vertical weight of pipe; a minimum of every floor for cast iron pipe. Space as noted for other piping.
 - 6. Changes in Direction: Provide support within 2 ft. of any change in direction or

unconnected end.

- G. Rod sizes for pipe hangers shall be as follows:
 - 1. Pipe 2 inches and smaller - 3/8" rod
 - 2. Pipe 2-1/2 inches and 3 inches- - 1/2" rod
 - 3. Pipe 4 inches and larger - 5/8" rod
- H. Support products shall be as cataloged by Fee and Mason, Elcen, Carpenter and Patterson, Grinnell, or approved equal.

2.8 UNIONS

- A. Unions shall be provided on inlet and outlet of all apparatus and equipment.
- B. Where valves are adjacent to equipment, unions shall be on downstream side of valves.
- C. Unions in copper pipe shall be cast bronze, WOG pattern, ground joint, 150 psi type.
- D. Unions in steel pipe shall be malleable iron, WOG female pattern, brass seat, ground joint, 150 psi type.
- E. Where dissimilar metal piping joins together, di-electric type unions shall be used to make the joint.

2.9 VALVES AND COCKS

- A. Valves and cocks shall be installed where shown on the drawings and/or where found to be necessary for proper operation of the system. All branches from risers, all branches from mains, and all fixtures or equipment not having stops shall be provided with valves whether shown or not.
- B. All valves shall be the product of one manufacturer as cataloged by Jenkins Brothers, Stockham, or Nibco.
- C. For water piping, valves shall be equal to 125 psi SWP/200 psi WOG Nibco as follows:
 - 1. Gate valves 1/2-inch to 3 inches = S-111
 - 2. Ball valves 1/2-inch to 2 inches = S-585
 - 3. Check valves 1/2-inch to 3 inches = S-413W

2.10 EXTERIOR HOSE BIBBS AND WALL HYDRANTS

- A. Wall hydrants shall be Zurn Model 1330, (or an approved equal) brass finish, freezeless, 3/4" size, vacuum breaker ASSE approved, automatic-draining. Contractor shall coordinate and

verify wall thickness before ordering faucets. Wall hydrants shall be installed in a secure manor and in accordance with manufacturer's recommendation.

2.11 TRAP PRIMERS

- A. Install on water closet flush valves and fixture supplies and cold water distribution piping where indicated.
 - 1. Cold Water Distribution Piping: PPP "Dual Flow" automatic floor drain trap primer. Provide with distribution unit where multiple floor drains are served.
 - 2. Flush Valves: Zurn Model P6000-TPO.
 - 3. Cold Water Fixture Supply: Zurn Model Z-1022-CP.

2.12 BACKFLOW PREVENTERS

- A. Reference civil drawings for size, type, and location, otherwise, reduced pressure principle type, Watts Model 909, ASSE and AWWA approved.

2.13 ELECTRIC WATER HEATERS

- A. Water heater shall have storage capacity and input KW as scheduled on the drawings. Units shall meet or exceed the energy requirements of ASHRAE Standard 90.1, shall be UL listed, and shall bear the Underwriters' Laboratories label. Tanks shall be coated with a ceramic coating which shall be warranted for a period of five (5) years against defects in materials and workmanship.
- B. Thermostats shall be immersion type with low wattage density element of the screw-in type.
- C. Provide unit complete with ASME rated pressure and temperature relief valve, vacuum relief valve, hose bibb, and galvanized drain pan.
- D. Terminate blow-off from relief valve full outlet size to points indicated.
- E. Water heater shall be Rheem, Ruud, Bradford White or A. O. Smith and shall be commercial type as indicated. Verify voltage from electrical plans.

2.14 THERMOSTATIC MIXING VALVE

- A. Valve and piping assembly shall be completely assembled with unions and fittings ready for installation. Valve and piping assembly shall have a rough brass finish with integral check stops, strainer, volume control shut-off valve, and color coded 3" face thermometer.
- B. The mixing valve shall conform to ASSE 1070 or CSA B125.3. The mixing valve shall have a solid bimetal thermostat directly linked to valve porting to control the intake of hot and cold water and compensate for supply temperature or pressure fluctuations. The valve inlet and outlet sizes shall be as indicated on the drawings. The mixing valve shall have a union angle

strainer, checkstops on inlets, adjustable high temperature limit stop set for 120 degrees F, internal parts of bronze, brass and stainless steel, integral wall support, cast lever handle, color coded dial, HOT-COLD, with directional indicators, and a maximum operating pressure of 125 PSI. The valve shall be Leonard "TM" Series or an approved equal. Selected valve shall be piped in strict accordance with manufacturer's printed instructions.

2.15 HOT WATER RECIRCULATING PUMP

- A. Shall be all bronze construction with one piece impeller, stainless steel shaft, and 3/4" flanges. 120 volt, single phase, control with strap-on aquastat. Unit shall be Taco, B&G, Armstrong, or approved equal. A pump curve with duty point indicated shall be submitted with shop drawing for pump approval.

2.16 ACCESS PANELS

- A. Provide Philip Carey, J. R. Smith, Zurn, or an approved equal. Unless noted otherwise, Smith Model #4761, 12" x 16" chromium plated steel access panels shall be installed where valves or shock absorbers occur in inaccessible walls or ceilings. It shall be the contractor's responsibility to coordinate access panel sizes to provide unrestricted valve service. All doors and covers to be completely removable from frames. All hinges must be concealed type. Steel frames shall be 16-gauge and doors 14-gauge. Access doors installed in fire rated assemblies shall be UL fire rated type with automatic closures. Access doors exposed to exterior conditions, installed in concrete block walls or poured concrete walls shall be stainless steel.
- B. Access panels installed in fire rated walls shall be U.L listed for use in a rated wall. Install per the manufacturer's installation details required for U.L listing.

2.17 SHOCK ABSORBERS

- A. Install Zurn Shocktrols or equal manufacturer shockstops, PDI rated at all flush valve fixtures and fixtures groups where indicated on the domestic water piping plan.
- B. In lieu of shocktrols, air chambers of same materials and diameter as the supply pipe and 12 inches in height may be installed at fixtures in accordance with local plumbing code requirements.

2.18 THERMAL INSULATION WORK

- A. All insulation work shall be performed by experienced insulation application mechanics thoroughly familiar with and experienced in the application of insulation materials. All insulation materials shall be applied in accordance with manufacturer's published recommended methods. Installation and finish of insulation materials shall meet with complete approval of the Architect. Contractor shall submit complete data for approval of materials and application methods as proposed for use. All piping shall be pressure tested and all surfaces shall be thoroughly cleaned before covering is applied. Insulation materials

including sealer, adhesive, finishes, etc., shall meet NFPA Standards with regard to flame spread and support of combustion.

- B. All piping as follows shall be covered with 1-inch thick heavy density fiberglass sectional pipe insulation equal to Owens-Corning Fiberglass 25 ASJ/SSL:
 - 1. Domestic Cold Water
 - 2. Domestic Hot Water

Note: Water piping below grade shall not be insulated.

- C. Storm drainage pipe run horizontal (exposed and concealed) shall be insulated for full horizontal run with 1" thick foil faced duct insulation including roof drain bodies. Vertical pipe shall not be insulated.
- D. Fittings for the above shall be insulated with premolded fitting insulation of the same material and thickness as the adjacent insulation and shall be covered with a plenum rated vapor barrier and sealed with vapor barrier lagging adhesive. Premolded plastic (PVC) covers shall not be installed in return air plenums. Adhere 3-inch wide butt joint strips over all end joints with vapor barrier adhesive. Covering adjacent to unions and other points of termination shall be finished with a plenum rated material neatly beveled.
- E. It shall be the responsibility of the insulation subcontractor to coordinate hanger locations and prevent crushing or breaking finishes.
- F. Traps and supplies of (ADA) handicapped lavatories and break room sinks shall be insulated with trap wrap protective kit 500R by Brocar or approved equal. Water cooler traps and above grade floor drain traps used for condensate removal shall be insulated with 1/2" Armalfex.

2.19 PLUMBING FIXTURES

- A. General: All fixtures including lavatories, urinals, water closets, etc., must be securely fastened to the walls or floor.
- B. Wall mounted fixtures: Support all wall mounted fixtures with solid blocking full length of fixture, built into wall or install a floor supported factory fabricated carrier system designed for securing selected fixture. Do not use toggle bolts or expansion bolts on metal stud walls.
- C. Water Closet Floor Connections: Provide cast iron or galvanized malleable iron floor flanges at 3/16" thick, screwed or caulked to drainage pipe. Bolt the connection and make tight to fixture with wax setting ring or polyethylene gasket flange.
- D. Water Supply Stub Outs: Provide brass nipple from water riser to fixture stop valve. (Steel pipe will not be approved). Exposed portion of nipple shall be chromium plated.
- E. Waste Arms to Fixtures: DWV copper or brass. Where copper or brass pipe is specified, all

joints downstream from trap shall have soldered joints.

- F. Fixture Trim: Exposed metal parts shall be of heavy weight polished brass, heavily chromium plated, of best quality as regularly furnished by the plumbing fixture manufacturer. Provide stop valve in supply to all fixtures and equipment.
- G. Traps: Traps shall be provided for all fixtures. Sink and lavatory traps shall be removable type, chromium plated brass a minimum of 17 gauge unless otherwise specified. Size of trap shall be full P.O. size of fixture.
- H. Flexible Water Supplies: Provide flexible supplies with angle stops for all fixtures as required and as shown on plans.
- I. Plumbing Fixture Schedule: Provide all fixtures where indicated on the plumbing drawings. Color of all fixtures shall be white unless otherwise indicated. Seats for all water closets shall be commercial grade solid plastic with open front.
- J. Provide rough-in for and connect to supply lines, waste and vent lines, all equipment, fixtures, drains, etc., specified herein or in other sections of the specifications which require such connection.
- K. Provide stop valves in hot and cold water connections to each fixture. Provide deep escutcheon on all sinks and lavatories where waste pipe penetrates the wall. Anchor all water supply pipe securely within wall spaces and plumbing chases.
- L. Fixture types are indicated on the drawings by means of the "P" numbers. All fixtures submitted for approval shall have rough-in measurements or attached rough-in sheets and identified with the associated "P" number.
- M. Floor drains shall be square type equal to Zurn ZN-415 Series with nickel bronze top and flashing collar. Floor drains shall be provided with trap primer tap as indicated on plans. Provide with square grates in lieu of round grates.
- N. Floor Sinks: 8"x8" floor sinks shall be equal to Zurn Z-1910 with 8"x8"x6" sump, inlet dome strainer and 1/2 top grate.
- O. Floor Sinks: 12"x12" floor sinks shall be equal to Zurn Z1901 with 12"x12"x8" sump, inlet dome strainer and 3/4 top grate.
- P. All exposed pipe and fittings shall be chromium plated brass unless otherwise indicated.
 - P-1 WATER CLOSET (ADA Compliant) – Kohler K-96058 17" high elongated bowl, with Zurn Z6000AV-WS1 flush valve with split ring pipe support. Provide with flexible riser with stop and Church 255 white open front seat less cover.
 - P-2 LAVATORY (Wall Hung, ADA Compliant) – Kohler K-2005, 20" x 18" wall hung vitreous china with Zurn Z81000-XL, 0.5 GPM single lever type faucet and grid type drain Provide McGuire 8872, 1-1/4", 17-gauge chromium plated P-trap with McGuire 167-LK angle

stops, flexible risers and Zurn ZR-1231 floor supported concealed arm carrier. Provide trap wrap 500R protective kit by Brocar or equal. Mount fixture in compliance with ADA for handicap use.

- P-3 HAND SINK (Counter Mounted) – Stainless steel, single compartment, Just SLX-2017-A-GR, 20" x 17" x 10.5" deep with T&S B-2865-4-122X rigid gooseneck faucet (minimum 5" clearance from deck to spray) with wrist blades and grid strainer. Provide 1-1/2", 17-gauge chromium plated tail piece, P-Trap, wall stops and flexible supplies equal to Eastman.
- P-3A HAND SINK WITH EYEWASH (Counter Mounted) – Stainless steel, single compartment, Just SLX-2017-A-GR, 20" x 17" x 10.5" deep with T&S B-2865-4-122X rigid gooseneck faucet (minimum 5" clearance from deck to spray) with wrist blades and grid strainer. Provide 1-1/2", 17-gauge chromium plated tail piece, P-Trap, wall stops and flexible supplies equal to Eastman. Provide with Bradley S19-200B faucet mounted eyewash and S19-2000 EFX8 navigator emergency thermostatic mixing valve.
- P-4 JANITOR SINK – Fiat Model TSB-3001 32"x32"x12" sink with stainless steel caps, MSG wall guards and 832AA hose/hose bracket. Provide Fiat 830-AA service faucet with top brace, stops, vacuum breaker, metal lever handles and threaded spout. Provide with 3" stainless steel drain.
- P-5 HI/LOW ELECTRIC WATER COOLER – Wall mounted, stainless steel, barrier free, bi-level water cooler, Elkay LZSTL8WSLK water cooler with LZWSR bottle filler. Provide with McGuire 8872 1-1/4", 17-gauge chromium plated P-trap (continuous waste), McGuire 167-LK angle stop, and Zurn Z-1225 floor supported concealed arm carrier. Mount fixture in compliance with ADA for handicap use.
- P-6 EMERGENCY EYEWASH/SHOWER – Bradley S19314 combination drench shower and eye/face wash. Provide with Navigator S19-2150 EFX20 thermostatic mixing valve.
- P-7 COFFEE MAKER VALVE BOX – Guy Gray BIM 875 with 1/2" FIB inlet x 1/4" O.D. outlet compression angle valve.
- P-8 ICE MAKER VALVE BOX – Guy Gray BIM 875 with 1/2" FIB inlet x 1/4" O.D. outlet compression angle valve.
- P-9 WASHING MACHINE BOX – Guy Gray B-200 with 2" center drain and bottom supply 1/2" angle stops.

2.20 ELEVATOR SUMP PUMP

- A. Provide all labor, material, equipment, and incidentals required to install a submersible sump pump as specified herein. The pump shall be equal to Stancor Oil Minder SE50. The unit shall produce 50 GPM at 15 feet of total dynamic head as a minimum.
- B. The pump shall be controlled with a Vertical Mechanical Float (VMG) type on/off switch.

- C. The pump castings shall be constructed of class 25 cast iron. The motor housing shall be oil filled to dissipate heat. All mating parts shall be machined and sealed with a Buna-N o-ring. All fasteners exposed to the liquid shall be stainless steel. The motor shall be protected on the top side with sealed cord entry plate with molded pins to conduct electricity eliminating the ability of water to enter internally through the cord. The motor shall be protected on the lower side with a unitized ceramic/carbon seal with stainless steel housings and spring. The pump shall be furnished with stainless steel handle.
- D. The pump shall be supplied with a 10 foot multi-conductor power cord. It shall be cord type SJTW, or SJTOOW capable of continued exposure to the pumped liquid. The power cord shall be sized for the rated full load amps of the pump in accordance with the National Electric Code. The power cable shall not enter the motor housing directly but will conduct electricity to the motor by means of a water tight compression fitting cord plate assembly, with molded pins to conduct electricity eliminating the ability of water to enter internally through the cord, by means of a damaged or wicking cord.
- E. Pump motor shall be oil filled, permanent split capacitor, class B insulated NEMA B design, rated for continuous duty. At maximum load the winding temperature shall not exceed 130 degrees C un submerged. The pump motor shall have an integral thermal overload switch in the windings for protecting the motor. The capacitor circuit shall be mounted internally in the pump.
- F. Upper and lower ball bearing shall be a single ball/race type bearing. Both bearings shall be permanently lubricated by the oil, which fills the motor housing. The motor shaft shall be made of 300 series stainless steel.
- G. The pump shall have a unitized carbon/ceramic seal with stainless steel housings and spring. The motor plat/housing interface shall be sealed with a Buna-N o-ring.
- H. The impeller shall be vortex style made of an engineered polymer, with pump out vanes on the back shroud to keep debris away from the seal area. It shall be threaded to the motor shaft.
- I. The exterior of the casting shall be protected with powder coat paint.
- J. The pump shall have cast iron support legs, enabling it to be a free-standing unit. The legs shall be high enough to allow 3/4" solids to enter the volute.
- K. Standard limited warranty shall be 3 years.

PART 3 – EXECUTION

3.1 PIPING INSTALLATION INSTRUCTIONS

- A. The Contractor shall provide for expansion and contraction of all piping and must make proper provisions so that there will be no undue strain on any of the piping or any part of the work.

- B. Wherever changes in sizes of piping occur, changes shall be made with reducing fittings. The use of bushings will not be permitted.
- C. Minimum bury for exterior piping shall be 18" below finish grade, or as required by local code.
- D. Cutting and boring through structural members shall be done only when approved by and under supervision of Architect and/or Structural Engineer.
- E. All pipe openings shall be closed with wooden plugs or metal or plastic caps during construction. The plugs or caps shall be installed when the pipes are roughed-in and shall not be removed until final connections are made.
- F. Fittings and lengths of pipe shall be examined internally before assembly and, if necessary, freed from scale or dirt. Piping shall be thoroughly blown out after assembly to remove foreign materials.
- G. Plated, polished or soft metal piping shall not show tool marks or abrasions.
- H. Offsets in all piping above grade shall be made with fittings. Bending of pipe shall not be permitted.
- I. All piping penetrations of fire proofing material shall be resealed using a U.L. listed fire proofing material.

3.2 EXCAVATION, TRENCHING AND BACKFILLING

- A. The Contractor shall do all slab cutting/removal and excavation necessary for pipe installation required in this section. He shall backfill all such trenches and excavations after work has been installed and tested, removing all surplus earth to such point as may be directed. Care must be taken in excavating that walls and footings and adjacent load bearing soils shall not be disturbed in any way except where lines must cross under a wall footing. Where a line must pass under a footing, the crossing shall be made by the smallest possible trench to accommodate the pipe. Excavations shall be kept free from water by pumping. Fill and backfill shall be in accordance with local plumbing code requirements and applicable requirements of "Earthwork" section.
- B. Trenches will be made true to grade by means of substantial and accurately set batter boards not more than 50 feet apart with taut cord or wire stretched between them. Care shall be exercised to insure that the pipe is bedded on undisturbed earth.
- C. Trenches located inside foundations walls and to a point five (5) feet outside of same shall be not less than 16 inches or more than 24 inches wider than the outside diameter of the pipe to be laid therein. Bottoms of trenches shall be accurately graded with bell holes scooped out to provide uniform bearing and support of pipe on undisturbed soil throughout its entire length, except where other means of supporting pipe are indicated. No greater length of trench shall be left open in advance of pipe and utility laying than that which is authorized or directed by the Architect.

- D. Bottoms of trenches shall be so shaped that when pipe is in place, the lower fourth of the circumference for the full length of the barrel will be supported on undisturbed earth. Bell holes shall be dug so that no part of the weight of the pipe is supported by the bell, but shall be no larger than necessary for proper jointing. Soft spots under pipe shall be excavated to solid subgrade. Rock or rocky materials shall be excavated to at least six (6) inches below pipe invert. Pipe bed shall then be backfilled with fine gravel or coarse sand, well tamped in place.
- E. Immediately after testing and/or inspection, the pipe trench will be carefully backfilled with earth free from clods, brick etc., to a depth one-half the pipe diameter and then firmly compacted in such a manner as not to disturb the alignment of joints of the pipe. Thereafter, the backfill shall be compacted tamped every vertical foot. No clods, brick, stones, etc., shall be placed in the trench. The last 18 inches of fill shall be clean earth.
- F. The Contractor shall be responsible for protecting his workmen, the workmen of others, or the work of others by shoring trenches and excavations where depth of trenches or excavations; wet, plastic or unstable soil; soil loaded with erected or stored materials; or any other such condition would cause a hazard. The Contractor may exercise his own judgment as to the necessity of shoring, but the Architect reserves the right to order shoring placed if he deems it necessary.

3.3 OPENINGS AND SLEEVE LOCATIONS

- A. This Contractor shall cooperate with the work to be done under other sections in providing information as to the openings required in walls, slabs, and footings for all piping including sleeves where required.
- B. Any drilling or cutting required for the performance of work under this section shall be the responsibility of this Contractor and the cost thereof shall be borne by him.
- C. Sleeves shall be furnished, accurately located and installed in forms before pouring of concrete. This Contractor shall pay all additional costs for cutting of holes as the result of the incorrect location of sleeves. All holes through existing concrete shall be either core drill or saw cut. All holes required shall have the approval of the Structural Engineer prior to cutting or drilling. Sleeves shall be inserted and grouted into place.
- D. It shall be the responsibility of this Contractor to ascertain that all openings are properly located.

3.4 MATERIALS AND EQUIPMENT

- A. All materials and equipment furnished under this section of the specifications shall be new, of quality specified, and as listed in printed catalogs of the manufacturer. Unless otherwise specified, all items shall have the manufacturer's standard finish.
- B. Each article of its kind shall be the standard product of a single manufacturer; however, the component parts of the plumbing system need not be the products of the same manufacturer.

- C. Trade names or manufacturer's names and manufacturer's model or figure numbers used in this specification are used to establish the type, character, and quality of materials and equipment to be furnished. Approved equal products of other manufacturers will be accepted.
- D. The Architect shall have the right to accept or reject material and equipment and determine when the Contractor has complied with the requirements herein specified.
- E. All manufactured materials shall be delivered and stored in their original containers. Equipment shall be clearly marked or stamped with the manufacturer's name and rating.

3.5 STERILIZATION

- A. The entire water distribution system shall be thoroughly sterilized with a solution containing not less than 50 parts per million of available chlorine. The chlorinating materials shall be acceptable by the State Board of Health authorities, and shall be introduced into the system in accordance with their recommendations. The sterilizing solution shall be allowed to remain in the system for a period of eight (8) hours during which time all valves and faucets shall be opened and closed several times. After sterilization, the solution shall be flushed from the system with clean water. The complete sterilization operation shall be approved by the State Board of Health authorities.

3.6 TESTS

- A. The Contractor shall notify the Architect and the plumbing inspector three (3) working days before any tests are to be made. All tests shall be made in their presence. Repair of defects that are discovered as a result of inspection of tests shall be made with new materials. Caulking of screwed joints, cracks, or holes shall not be accepted. Tests shall be repeated after defects have been eliminated.
- B. Tests of Sanitary Sewer and Storm Water Piping: A water test shall be applied to all parts of the drain and vent system before piping is concealed or fixtures set in place. All openings to be plugged water tight, the entire system filled with water to the top of vents through roof, (or no less than 10 foot head of water) and left at least 30 minutes without leakage. After fixtures are permanently connected and traps are filled with water, entire sanitary system shall be smoke tested in accordance with the requirements of the International Plumbing Code Section 312. A ball test shall be performed to insure a complete operation of the sanitary waste system.
- C. Test of Domestic Water Piping: A water test shall be applied after installation of piping is complete but, before piping is concealed, and before plumbing fixtures are connected.
- D. System shall be filled with potable water and kept under hydrostatic pressure of 150 pounds per square inch for two (2) hours with no leaks.
- E. All equipment and materials required for tests shall be provided by the Contractor.

3.7 CLEANING EQUIPMENT AND MATERIALS

- A. Provide for the safety and good condition of all materials and equipment until final acceptance by the Architect. Protect all materials and equipment from damage. Provide adequate and proper storage facilities during the progress of the work. Special care shall be taken to provide protection for bearings, open connections, pipe coils, pumps, compressors and similar equipment.
- B. All fixtures, piping, finished surfaces and equipment shall have all grease, adhesive labels and foreign materials removed.
- C. All piping shall be drained and flushed to remove grease and foreign matter. Pressure regulating assemblies, strainers, traps, flush valves and similar items shall be thoroughly cleaned.
- D. Any equipment or material that is damaged or marred shall be replaced with no additional charges when so directed by the Architect.
- E. Upon completion of the work, the Contractor shall remove from the premises all unused material and debris resulting from the performance of work under this section, and leave the premises in a finished, clean and sanitary operating condition ready for occupancy by the Owner.

3.8 OWNER TRAINING

- A. The plumbing contractor shall provide the owner with training on the operation and maintenance of the cold water and hot water system. This training shall include operation of all water heaters, pumps, mixing valves, etc. The training shall be scheduled through the Commissioning Agent.

END OF SECTION 22 00 50

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SECTION 23 05 00 - GENERAL REQUIREMENTS FOR MECHANICAL WORK

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 CONTRACTORS QUALIFICATIONS

- A. General: Wherever the word "sub-contractor" or "firm" is used in these sub-paragraphs, it shall mean the contractor/sub-contractor of record for the installations used for proficiency qualification.
- B. Location: The firm which performs the installation of the work under this section shall be one who maintains an established, experienced organization with a permanent, manned office.
- C. Plumbing Experience: The firm's proficiency in the installation and adjustment of plumbing systems shall have been demonstrated by the successful performance of work as specified herein on at least three commercial or institutional buildings, each containing a minimum of 40 plumbing fixtures. The firm shall have Certified Plumbing Contractor licensed personnel. Proof of this license shall be submitted within 24 hours after the bid opening. The firm shall have been in business performing services as specified herein, for at least 3 years.
- D. HVAC Experience: The firm's proficiency in the installation, start-up, adjustment, and maintenance of air conditioning systems shall have been demonstrated by the successful performance of work as specified herein on at least three systems each with ducted air distribution, and hydronic and refrigerant piping of 200 tons capacity or greater. The firm shall have Certified Mechanical Contractor licensed personnel, instruments, tools, and equipment to perform the installation, balancing, and maintenance service specified. Proof of this license shall be submitted within 24 hours after the bid opening. The firm shall have been in business performing services as specified herein, for at least 3 years.
- E. Fire Protection System Contractor: The firm's proficiency in the installation of fire protection systems shall be demonstrated by the successful performance of work as specified herein on at least three commercial projects exceeding 50,000 square feet of protected floor area. The firm shall have Fire Protection Contractor II, Type 07, Class 16 licensed personnel. Proof of this license shall be submitted within 24 hours after the bid opening. The firm shall have been in business performing services herein for at least 3 years.
- F. Test and Balance: The firm's proficiency in the test and balance of the air conditioning systems shall have been demonstrated by the successful performance of work as specified herein on at least three systems each with ducted air distribution hydronic systems, and refrigerant piping of 200 tons capacity or greater, incremental units excluded. The firm shall have trained personnel, instruments, tools, and equipment to perform the testing and

balancing service specified. The firm shall have been in business performing services as specified herein, for at least 3 years and be independent of the mechanical contractor and shall be an active member of AABC or NEBB.

- G. Commissioning Agent: The Commissioning Firm shall have professional and technical personnel dedicated to providing commissioning services as a regular business service offering. The lead commissioning professional for the project shall hold one of the following active certifications: ACG Commissioning Authority (CxA), BCA Certified Commissioning Professional (CCP). The commissioning professional shall have documented experience of serving as the lead commissioning professional on at least five (5) projects of similar size and complexity. Technical personnel regularly representing the Commissioning Provider on the project site for inspections, testing, and meetings shall be graduate mechanical engineers or shall be ACG Certified Commissioning Technicians (CxT), or BCA Associated Commissioning Professional (ACP).

1.3 GENERAL SCOPE OF WORK

- A. This project is for the construction of the heating, ventilating and air conditioning systems, plumbing and fire protection systems for the Gulf Coast Plastic Surgery – Surgery Center. It is intended that specifically identified equipment shall be installed new to ensure complete and functional systems. More specifically, equipment included in this scope of work shall be, but is not limited to:
 - 1. Air Cooled Water Chillers
 - 2. Variable Air Volume Air Handlers
 - 3. Variable Air Volume Boxes
 - 4. Chilled Water Piping Systems
 - 5. Domestic Water Piping Systems
 - 6. Plumbing Fixtures
 - 7. Water Heaters
 - 8. Fire Protection System
- B. The contract drawings specifically describe the work required for each unit of equipment. The contract specifications specifically describe the products to be provided. All documents shall serve as an integral part of the other and be considered as one. Any conflicts between these documents shall be resolved prior to bidding. It is expected the worst case description shall take precedence in the event of a discrepancy.
- C. The owner may opt to purchase materials used in construction directly. Reference the Special Conditions section of the project specifications for additional information.

1.4 GENERAL REQUIREMENTS

- A. Scope of Section: Include all materials, equipment and labor necessary for complete and properly functioning mechanical installations in accordance with local and state codes, contract drawings and as specified in all 21 series, 22 series and 23 series specifications.

1.5 DRAWINGS

- A. Mechanical drawings indicate the general arrangement and extent of work. Exact locations and arrangements of materials and equipment shall be determined in the field prior to beginning any work to conform in the best possible manner with the surroundings and with the adjoining work of other trades. References to locations of equipment, devices or fixtures shall be verified in the field with actual dimensions and not by scaling drawings.

1.6 COORDINATION OF WORK

- A. Prior to installation, coordinate all work with work of other trades and with field conditions in sufficient detail to preclude interferences between the work of different trades and to insure necessary clearances at equipment. Work requiring necessarily fixed locations such as graded piping shall take precedence over work not requiring such fixed locations and shall establish permissible routing of services associated with the latter. Should work be performed without adequate coordination so that interferences occur between work of different trades, Contractor shall eliminate such interferences by requiring necessary rework by the trades involved. Such rework shall meet approval of Engineer and shall incur no additional cost to Owner.
- B. The Contractor shall coordinate the contract drawings and specifications for all other trades, and shall report any discrepancies between them to the Engineer and obtain from him written instructions for changes necessary in the mechanical or electrical work. All work shall be installed in cooperation with all other trades. Before installation, the Contractor shall make proper provision to avoid interferences in a manner approved by the Engineer. All changes required in the work of the Contractor due to his neglect shall be corrected by the Contractor at his own expense.

1.7 CODES, PERMITS, TAXES

- A. Governing Law: Refer to "General Conditions". Work shall meet requirements of applicable codes, ordinances, rules and regulations, in effect at time of signing contract of any body or bodies having jurisdiction, including utilities.
- B. Correction of Work: Work done contrary to above requirements shall be corrected at no additional cost to Owner.
- C. Permits, Fees and Taxes: Refer to "General Conditions". Secure and pay for all necessary permits, inspections, licenses, meters, connections, etc. that may be required; pay all required taxes. Owner shall pay any environmental impact fee incurred.
- D. Applicable Codes and Standards
 - 1. Florida Building Code – Building 2020 with all supplements
 - 2. Florida Building Code – Plumbing 2020 with all supplements
 - 3. Florida Building Code – Mechanical 2020 with all supplements
 - 4. ASHRAE 90.1 - 2016

5. SMACNA Standards for Duct Construction
6. NFPA 13 (2016 ed.) – Standard for Installation of Sprinkler Systems.
10. NFPA 90A (2015 ed.) – Standard for the Installation of Air Conditioning and Ventilating Systems

1.8 DISCREPANCIES

- A. In case of difference between drawings and specifications or where drawings and/or specifications are not clear or definite, the subject shall be referred to Engineer for clarification and instructions. Such items should be directed to Engineer prior to taking bids.

1.9 SUBMITTALS

- A. Refer to Section "General Requirements".
- B. Material List: Within thirty (30) days of award of contract submit a complete list of materials to be provided for the mechanical work. List shall include manufacturer's name and catalog number or series for each item on list.
- C. Shop Drawings: Before commencing work, submit drawings of all mechanical materials and equipment to be furnished under this contract. In addition, submit other drawings or diagrams, dimensioned and in correct scale, requested by Engineer to clarify the work intended to show its relationship to adjacent work or work of other trades. Drawings shall clearly indicate all characteristics, special modifications or features, and exceptions to or deviations from contract requirements.
 1. Shop Drawings: Drawings shall be a minimum of 8 1/2" x 11" in size, except as specified otherwise. Submittal shall be assembled in hard black 3-ring binders with numbered index sheets and tabs.
 2. Manufacturer's Data: Submittals for each manufactured item shall be manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts. All equipment selections shall be clearly marked with name designations shown on drawings (i.e., AHU-1, HPU-2, etc.).
 3. Delivery and Storage: Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Architect. Damaged or defective items, in the opinion of the Architect, shall be replaced.
 4. Cataloged Products: Materials and equipment shall be cataloged products of manufacturers regularly engaged in production of such materials or equipment and shall be manufacturer's latest design that complies with the specification requirements. Materials and equipment shall duplicate items that have been in satisfactory commercial or industrial use at least 2 years prior to bid opening. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the items need not be the products of the same manufacturer.

- D. Samples: Submit samples of materials upon request for approved substitutions and as listed elsewhere herein. Samples shall duplicate materials, workmanship, and finish of products intended for installation.

1.10 RECORD DRAWINGS

- A. Provide in accordance with "General Requirements" section.

1.11 INSTRUCTIONS

- A. Personnel: After completion of installation, competent personnel shall be furnished to instruct Owner's personnel in operation and maintenance of systems.
- B. Written: Furnish three (3) copies of instructions for operating various systems, including complete description of functions and operations of each piece of equipment, automatic control hook-up. Control devices shall be identified and their actual location in building noted on diagrams. Include cleaning, oiling, and greasing instructions of each item of equipment. Spare parts list and source of supply shall be identified for each item of equipment. Furnish in loose leaf hardboard 3-ring binders to Engineer (for delivery to Owner).

1.12 FINAL CHECK

- A. Before submitting proposals, each bidder shall examine all drawings and specifications issued by the Engineer and shall examine the site of work. He shall be fully informed as to character of his work and coordination of his work with that of other trades. No consideration will be given at a later date for alleged misunderstandings as to requirements of work, materials to be furnished or conditions required by nature of site.

1.13 FOUNDATIONS

- A. The Contractor shall furnish all special foundations and supports for equipment which he installs and which are separate and distinct from building construction as shown by Engineers drawings. Support equipment from building structures in a manner acceptable to the Engineer.

1.14 SAFETY PROVISIONS

- A. Belt, pulleys, chains, gears, couplings, projecting set screws, keys and other rotating parts located so that any person may come in close proximity thereto, shall be fully enclosed or properly guarded.

1.15 RELATED WORK

- A. The following items of material and labor incidental to or related to the work will be provided as follows:

- B. Cutting and patching of existing building structure for location of pipes, air ducts, etc., shall be provided by this Contractor. Patching and finishes shall be performed by affected trades.
- C. Furring around pipes, ducts, etc., shall be by General Contractor.
- D. All exposed metal work shall be coated or painted with a corrosion resistant material. Coordinate procedure and color with Architect.
- E. All electrical power wiring, conduit, etc., for motors and motor starters shall be furnished and installed by the electrical contractor. Electrical automatic control devices, relays, etc., required for electrical interlock for operation of system shall be furnished complete by this Contractor in strict accordance with all requirements of wiring specifications as a part of the control system. Motor starters shall be provided under this section of this specification.

PART 2 - PRODUCTS

2.1 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage:

1. Contractor shall be responsible for inspecting materials delivered to site for damage.
2. Materials shall be stored on site in enclosures or under protective coverings. Materials shall not be stored directly on ground.

B. Handling:

1. Equipment, pipe, fittings, valves, and other accessories shall be handled in such a manner as to ensure delivery to the job site in sound, undamaged conditions.
2. Special care shall be taken to avoid injury to coatings and linings on equipment, pipe and fittings. The contractor shall repair damaged coatings and linings to the satisfaction of the Owner.

2.2 QUALITY

- A. Conform to the quality and features specified and indicated on drawings. Where material or equipment is indicated or necessary, but not specifically described in the specifications or drawings, such shall conform to the quality and features of similar items so described or otherwise indicated.

2.3 SLEEVES

A. Pipe Sleeves:

1. Walls and Partitions: Sleeves 8" Diameter and Smaller (Above Grade): Schedule 40 galvanized steel or plastic (unless specifically noted otherwise) built into wall, partition or beam sized to pass pipe and covering, leaving a clear space of 1/4" minimum between covering and sleeves.

2. Floors (Above Grade): Schedule 40 galvanized steel or plastic, set before floor is poured, sized to pass pipe and covering, leaving a clear space of 1/4" between covering and sleeve, and shall extend 1/2" above finished floor.
3. Sealing of Sleeves:
 - a. Above Grade: Make openings around pipes, etc., passing through sleeves draft-free and vermin-proof by packing solidly using mineral wool or glass fiber.

2.4 SUPPORTING DEVICES

A. Inserts:

1. Preset Type: Malleable iron with removable interchangeable nuts having lateral adjustment of not less than 1 5/8". Continuous inserts shall have a capacity of 2000 lbs. per foot and shall be hooked over reinforcing. Acceptable: C-B Universal Fig. 282; Unistrut Products Co., P-300; Binkley B-32-1.
2. Afterset Types: Self-drilling style expansion shields shall be used in concrete and brick. Toggle bolts shall be used on block walls and partitions.

B. Steel Framing:

1. Support hangers from bar joists with clamps or other means acceptable to Engineer.
2. Hangers shall be plumb within 2" in 4' and spaced as required for the service intended.
3. Where unforeseen conditions necessitate additional hangers, install same in locations subject to Engineer's approval.

C. Stud Partitions:

1. All anchorage shall be to studs or solid blocking built into the wall.

D. Equipment, Piping and Duct Hangers:

1. Provide angles, brackets, clamps, anchors, braces, frames, rods and other miscellaneous steel items as necessary for support of equipment and piping specified herein. All supporting components not exposed to exterior conditions shall have hot dipped galvanized finish. All supporting components exposed to exterior conditions and installed in open process areas and equipment rooms shall be stainless steel.
2. All piping, ducts, etc., shall be run parallel with the lines of the building, unless otherwise shown or noted on the drawings. The different service pipes, valves, fittings, etc., shall be so installed that after the covering is applied there will be not less than 1/2" clear space between the finished covering and other work, and between the finished covering of parallel adjacent pipes. Hangers shall be so spaced to prevent sag and to permit proper drainage. Exact location of piping, ducts, etc., shall be coordinated between subcontractors so that there will be no interference.
3. Pipe shields shall be provided at all pipe hangers supporting insulated pipe. Pipe shields shall be provided in conjunction with wood spacers of equal thickness to insulation and placed on bottom half of pipe between pipe and hanger.

2.5 FLOOR, WALL AND CEILING PLATES OR ESCUTCHEONS

- A. Furnish escutcheons or fabricated plates or collars and install at each location where pipe or duct passes through a finished surface. Escutcheons for flush sleeves shall be equal to Benton & Caldwell No. 3A chromium plated brass; for sleeves extending above floor shall be equal to Benton & Caldwell No. 36 chrome plated brass. Collars or plates for ducts and large diameter insulated pipe shall be fabricated of 18-gauge galvanized copper bearing steel, or stainless steel, secured to structure and neatly fitted around duct or pipe.

2.6 ACCESS DOORS

- A. Each door shall be equipped with two flush, screwdriver operated cam latches and other than Style "M" shall be finished to match adjacent surface. Door sizes shall be applicable to the access required for normal service. Doors shall be manufactured by the Inryco/Milcor or an approved equal, as follows:

Location	Milcor Style
Drywall	"DW"
Masonry or Tile	"M-Stainless"
Acoustical Tile	"AT"
Plaster	"K"
Fire-rated Wall	"Fire Rated"

- B. Furnish as necessary for access to concealed valves, cleanouts, unions, expansion joints, dampers, coils, junction boxes, etc., where no other means of access is shown or specified.

2.7 BELT DRIVES

- A. Each motor driven machine not direct connected shall be equipped with V-belt drive. Belts shall be of correct cross section to fit properly in sheave grooves. Belts for each drive shall be carefully matched. Sheaves shall be of cast iron or steel, bored to fit properly on shafts and secured with keys of proper size. Variable and adjustable pitch sheaves shall be furnished for fans and shall be selected to that required rpm will be obtained with sheave set approximately in mid-position. Rating of each drive shall be as recommended by manufacturer for service, but shall be at least 1.5 times nameplate rating of motor.
- B. Mechanical Contractor shall be responsible for providing and installing all necessary sheaves required to properly balance systems.

2.8 BELT AND COUPLING GUARDS

- A. Equip each belt drive with a guard constructed of #12 U.S. standard gauge 3/4" diamond mesh steel wire screen or equivalent, welded to 2" steel angle frames which shall enclose all belts and sheaves. Tops and bottoms of guards shall be of #18 U.S. standard gauge steel. Braces or supports must not "bridge" sound and vibration isolators. Guards shall be designed with adequate provision for movement of motor required to adjust belt tension. Provide means to permit oiling, use of speed counters, and other maintenance and testing operations with

guard in place. All direct drive equipment shall have coupling guards in accordance with Florida Department of Business Regulation safety regulations.

2.9 PAINTING AND MARKING

- A. Painting: Painting of equipment, pipe, and ducts (insulated or un-insulated) shall be as specified in Section "Painting". Touch up of shop coats shall be performed under section furnishing equipment and shall match equipment factory finishes.
- B. Marking:
 - 1. Pipes: All utility piping above and below the ceiling shall be stenciled with name of service to indicate the use of pipe and with arrows to indicate direction of flow. Stencils shall be applied after final painting is completed. In lieu of stencils, pipe identification labels similar to "Brady" may be used. Bands shall be color coded. Markings shall be in accordance with ANSI Standard A-12.1.
 - 2. Equipment: Piping, ducts, etc., shall be stenciled as specified above. Air moving equipment, valves, starters, control devices, etc., shall be neatly labeled with permanently attached 3/4" engraved plastic labels, white letters on black background. Hand marked labeling will not be accepted.

PART 3 - ELECTRICAL

3.1 GENERAL

- A. Unless specified otherwise, motors, starters, and control devices shall be furnished under the division of the specifications that covers the driven equipment. Motor starters shall be installed by the electrical contractor except where as an integral part of the equipment. Reference electrical plan for location of starters relative to specific equipment. All electrical power wiring, conduits, and connections shall be provided under the Electrical Section. Contractor furnishing driven equipment shall coordinate wiring diagrams with contract requirements and shall furnish coordinated wiring diagrams for installation.
- B. Motors: Unless otherwise specified, each motor shall have sufficient capacity to start and operate the machine it drives without exceeding the motor nameplate ratings the speed required. (Except that the NEMA standard service factor may be applied to motors that are water or refrigerant cooled). The horsepowers specified are those estimated to be required by the equipment when operating at specified duties and efficiencies. If the actual horsepower for the equipment to be furnished differs from that specified or indicated on drawings, it shall be the responsibility of the Section furnishing equipment to insure that proper size feeders, breakers, etc., are provided at no change in contract cost. Motors shall be rated for continuous duty, at 100% of nameplate rating with a service factor of 1.15. Squirrel cage induction motors shall have normal starting torque, full voltage low starting current, constant speed continuous duty type. Motors shall be wound for specified voltage.
- C. Starters shall be furnished under this section of the specification:

1. General: As specified with modifications and accessories as indicated in other Sections of this specification or by control diagrams on drawings. Starters shall have proper rating for motors controlled.
 2. Over Current Protection: Contacts shall break each ungrounded line to the motor. A thermal Over current device shall be provided in each ungrounded line. All contacts shall open simultaneously upon tripping of any Over current device.
 3. Magnetic Starters: For motors of 1/2 HP or larger, combination type with unfused disconnect switch, unless specified otherwise in other sections. Each starter shall have a control transformer with fused 120 volt maximum control circuit. Control transformer shall be of adequate capacity for all controls on the circuit. Starters shall have on-off-automatic switches in cover.
 4. Manual Starters: Provide for motors through 1/3 HP unless specified otherwise under equipment specifications.
 5. All starters shall be provided with hand-off-auto switches.
- D. All Motors that are 3 HP and above shall be provided with phase loss/phase reversal protection equal to the SymCom Motor Saver 460 with manual reset.

PART 4 - EXECUTION

4.1 TESTS

- A. General: All equipment and materials required for system testing shall be provided by the contractor. Provide 48 hours notification in advance of any test. Test shall be maintained at conditions specified but, in no event, for less than 8 hours minimum duration, unless otherwise noted. Hydrostatic pressure test shall maintain pressure without change, except that due to temperature change. Complete test prior to insulating. Leaks shall be repaired, defective materials replaced, and system shall be retested. No water pressure test shall be conducted in freezing weather where subject to freezing. Strike all joints in copper and steel piping under pressure test. Conduct tests prior to connecting to equipment or isolate equipment from system. Submit affidavit of pressure tests compliance to Engineer.
- B. Tests of Sanitary Sewer and Storm Water Piping: A water test shall be applied to all parts of the drain and vent system before piping is concealed or fixtures set in place. All openings to be plugged water tight, the entire system filled with water to the top of vents through roof, (or no less than 10 foot head of water) and left at least 60 minutes without leakage. After fixtures are permanently connected and traps are filled with water, entire sanitary system shall be smoke tested in accordance with the requirements of the International Plumbing Code Section 312. A ball test shall be performed to insure a complete operation of the sanitary waste system.
- C. Test of Domestic Water Piping: A water test shall be applied after installation of piping is complete but, before piping is concealed, and before plumbing fixtures are connected.
- D. System shall be filled with potable water and kept under hydrostatic pressure of 150 pounds per square inch for eight (8) hours with no leaks.

- E. Test of Natural Gas Piping: After installation of the piping, but before piping is concealed and installation of the station service fittings, the line shall be blown clear by means of water pumped (oil-free) nitrogen or air. Each section of the piping system shall be subjected to a test pressure of one and one-half times maximum working pressure, but in no case less than 150 psig, by means of oil-free (water-pumped) nitrogen or air. This test pressure shall be maintained until each joint has been examined for leakage by means of soapy water. All leaks shall be repaired and the section retested. After installation of station service fittings, a 24-hour standing pressure test with oil-free (water-pumped) nitrogen or air at one and one-half times maximum working pressure, but in no case less than 150 psig, shall be made to determine that the entire system is free from leaks. After completion of the final standing pressure test, the system shall be thoroughly flushed with the gas to be used in the system to assure the removal of all nitrogen or air.

- F. Refrigerant Piping:
 - Pressure test; 200 PSIG and 150 PSIG dry nitrogen on high and low sides respectively; 6 hours minimum duration.
 - Vacuum test; 500 microns; 15 minutes minimum duration.
 - Break vacuum with dry nitrogen and re-evacuate to 500 microns.
 - Break vacuum with dry nitrogen and re-evacuate to 500 microns.
 - Break vacuum with refrigerant charge.

- G. Chilled Water: Hydrostatic test; 150 PSIG.

- H. Medium and High Pressure Ductwork: Test in accordance with SMACNA HVAC Air Duct Leakage Test Manual, 2012 Edition. Ducts shall be tested at 3" W.C. and provide Class A leakage seal.

4.2 ACCEPTANCE

- A. Prior to requesting final inspection:
 - 1. Complete work required by drawings and specifications.
 - 2. Balance air conditioning system in accordance with Section "Test and Balance".
 - 3. Acceptance will be by Engineer on basis of tests and inspection of project. Contractor shall furnish necessary mechanics to operate system, furnish test instruments and equipment as required, make necessary adjustments and assist with final inspection.

4.3 OPERATING AND MAINTENANCE MANUALS

- A. Three (3) bound and indexed Operating and Maintenance Manuals shall be prepared by the Contractor for all equipment and be submitted for approval a minimum of one month prior to "substantial". Two (2) approved copies shall be delivered to the operating personnel at final observation.

- B. Each Manual shall be compiled as follows:

1. Data shall be bound in smooth surface hard back commercial quality three-ring notebooks with project identification shown on the front cover and binding back. Identification labels shall be typed and adhered.
 2. Notebooks shall have 9 1/2-inch by 11 1/2-inch covers with back width to permit the covers to lie parallel or to converge, and have not less than 1 1/2-inch back width.
 3. Index divider sheets of heavy Manila paper shall be inserted between each section of the Manual with a 2-inch x 1/3-inch ready-cut shield tab attached to each sheet for identification of sections.
 4. Data sheets and diagrams shall be 8 1/2-inch x 11-inch or be mounted on 8 1/2-inch x 11-inch sheets of 16-pound paper if smaller, with reinforced 11-inch mechanically perforated edge. Drawings and diagrams larger than 8 1/2-inch by 11-inch shall be folded up from the bottom to form a height of 11 inches and folded to the left to form a width of 8 1/2 inches.
- C. Index sheets shall be provided in the order listed with the following identifications typed in capital letters:
1. PLUMBING FIXTURES.
 2. SYSTEM DISCRETE HVAC COMPONENTS: (Chillers, Air Handlers, Boilers, Pumps, Split System Heat Pumps, etc.)
 3. AIR DISTRIBUTION.
 4. FANS.
 5. FILTERS.
 6. WATER DISTRIBUTION.
 7. CONTROLS.
 8. TEST AND BALANCE REPORTS.
 9. WATER HEATER.
 10. CERTIFICATES.
 11. VALVES AND PIPING SPECIALTIES.
- C. Each Manual shall contain the following information, data and drawings:
1. List of contents. Insert under front cover.
 2. Copy of reviewed submittals, equipment and materials.
 3. Manufacturer's installation, operating and maintenance instructions for each item of equipment with moving parts listed under SHOP DRAWINGS including recommended frequency of inspections and maintenance for one year's period of time.
 4. Manufacturer's list of renewal parts for each item of equipment with recommended stock items and quantities indicated.
 5. Control diagrams, electrical interlock diagrams, and control valve lists.
 6. Copy of shop drawings showing layouts and construction details.
 7. Copy of Test and Balance Reports including list of instruments and description of methods employed.

4.4 WARRANTY

- A. Reference Administrative Section of these specifications ASpecial Terms and Warranties@ for warranty requirements. This Administrative Section shall take precedence over all other warranty descriptions.
- B. All warranties shall include material and labor and extend for one (1) year from the date of substantial completion. Additional warranty requirements listed in the Division 15 Specifications that exceed this requirement shall also apply as noted.

END OF SECTION 23 05 00

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SECTION 23 05 93 - TESTING AND BALANCING AIR AND WATER DISTRIBUTION SYSTEMS

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 GENERAL REQUIREMENTS

- A. The General Conditions, Supplementary Conditions and Division 1, General Requirements, apply.
- B. This section of the specifications shall be included in the Mechanical Contractor's Bid.

1.3 RELATED WORK SPECIFIED ELSEWHERE IN THE SPECIFICATIONS

- A. General Requirements for Mechanical Work – Section 23 05 00.

1.4 QUALITY ASSURANCE

- A. Contractor Provided Testing Agency:
 - 1. Reference Specification 23 05 00 for contractor's required qualifications.
 - 2. Procedures shall be as outlined in the AABC Publication "National Standards for Total System Balance", 7th edition.

1.5 SUBMITTALS

- A. Test Reports: After completion, submit five (5) certified copies of test and balance report to the Architect for review and as a project record document.

1.6 JOB CONDITIONS

- A. Commencement of Test: Do not begin balancing until the systems have been completed and are in full working order, or at the direction of the Architect, place any part thereof in operation for the purpose of balancing.
- B. Plans and Data: Furnish the balance agency one (1) complete set of all approved up-to-date mechanical plans and shop drawings of all cooling, heating, air, and water distribution equipment.

1.7 FIELD QUALITY CONTROL

- A. Performance Data: Record the following data and submit to the Architect.
1. Leak test all spiral duct systems and submit results to Architect. Testing procedure shall conform to AABC and leakage rate shall not exceed their recommendations.
 2. Air Volumes and Velocities: Determine and tabulate at each grille, diffuser, louver, outside air intake, etc., and adjust dampers, control devices and fan drives to obtain the indicated air quantities. Adjust or modify each supply grille and diffuser distribution pattern as required to maintain air motion, noise level and temperature variations within acceptable limits throughout each space. Clearly and permanently mark all dampers at final setting for reported air balance.
 3. System Component Capacity: Record and calculate all data necessary to demonstrate capacity under actual operating conditions, and adjust dampers, valves, control valves and machine drives to obtain a suitable operating balance for each system. Record data for each item of equipment simultaneously with data from all associated equipment together with coincident outside air dry bulb temperatures to permit evaluation of total system performance. Data to include the following:
 - a. Supply, return and outside air quantities for each air conditioning and ventilation system.
 - b. Air volumes and velocities for each fan, cooling coil and air cleaning assembly.
 - c. Entering and leaving air dry bulb and wet bulb temperature for each cooling and heating coil.
 - d. Static pressures for all air handling units and major fans.
 - e. Actual voltage and current input for each motor.
 - f. Test and adjust each diffuser grille, and register within 10 percent of design requirements. Test and record temperature rise, voltage, and current across duct heaters.
 4. In readings and test diffusers, grilles and registers include required fpm velocity and test fpm velocity, and required cfm and test cfm after adjustments.
 5. Check and record water flow, entering and leaving temperatures for all chillers, pumps, air handling units, etc.
 6. Mechanical contractor is responsible for providing and installing all necessary sheaves required to properly balance systems.

1.8 TEMPERATURE CONTROLS

- A. Set adjustments of all controllers to operate as indicated. Make four hour temperature traverse of each area or zone. Provide testing agency personnel with instruments to verify reports to Architect.

1.9 FINAL TESTING

- A. At conclusion of testing agency's work, demonstrate to the Architect that the equipment is mechanically sound, that the systems deliver the rated output without objectionable noise, distress or vibration, and that the temperature controls are functioning properly.

END OF SECTION 23 05 93

SECTION 23 08 00 - COMMISSIONING OF HVAC AND LIGHTING SYSTEMS

PART 1 - GENERAL

1.1 COMMISSIONING AGENCY

- A. The commissioning agency (CxA) shall be contracted by the general contractor. The CxA has overall responsibility for planning and coordinating the commissioning process. However commissioning involves all parties to the design and construction process.
- B. The commissioning agency shall be a Certified Commissioning Authority as defined by the AABC Commissioning Group or by ASHRAE.
- C. Reference Section 23 05 00 "General Requirements for Mechanical Work" for contractor qualifications.

1.2 DESCRIPTION

- A. The commissioning scope shall include all tasks required to comply with Section C408 of the Florida Building Code – Energy Conservation, 7th Edition (2020).
- B. The commissioning agency shall develop and submit a commissioning plan. This plan shall include the following.
 - 1. A narrative description of the activities that will be accomplished during each phase of commissioning, including the personnel intended to accomplish each of the activities.
 - 2. A listing of specific equipment, appliances or systems to be tested and a description of the tests to be performed.
 - 3. Functions to be tested including, but not limited to, calibrations and economizer controls.
 - 4. Conditions under which the test will be performed. At a minimum, testing shall affirm winter and summer design conditions and full outside air conditions.
 - 5. Measurable criteria for performance.
- C. The commissioning agency shall submit a preliminary commissioning report. This report shall include the following.
 - 1. Itemization of deficiencies found during testing required by this specification that have not been corrected at the time of the report preparation.
 - 2. Deferred tests that cannot be performed at the time of the report preparation because of climatic conditions.
 - 3. Climate conditions required for the performance of the deferred tests.
- D. The commissioning agency shall submit a final commissioning report. This report shall include the following.

1. Results of functional performance tests.
 2. Disposition of deficiencies found during testing, including details of corrective measures used or proposed.
 3. Functional performance test procedures used during the commissioning process including measurable criteria for test acceptance.
- E. The test and balance report submitted by the TAB agency shall be verified for accuracy by the commissioning agency. The quantity of TAB measurements that are verified shall be at the discretion of the commissioning agency. The TAB agency shall be present during this activity and shall correct any deficiencies that are identified.
- F. The HVAC systems listed below shall be subjected to functional performance testing. The mechanical contractor and controls contractor shall be present during this activity and shall correct any deficiencies that are identified.
1. Heat systems – All
 2. Cooling systems – All
 3. Exhaust systems – All
 4. HVAC control system, including graphical user interface
- G. The automatic control system for building lighting shall be subjected to functional performance testing. The electrical contractor shall be present during this activity and shall correct any deficiencies that are identified.

1.3 SUBMITTALS

- A. The name of the commissioning agency, along with proof of certification, shall be submitted as part of the shop drawing process. Reference Specification 23 05 00 for submittal requirements.
- B. Commissioning Team: List of team members who will represent the contractor to the pre-commissioning checks and functional performance testing, at least 2 weeks prior to the start of pre-commissioning checks.
- C. Test Schedule: Schedule for pre-commissioning checks and functional performance tests, at least 2 weeks prior to the start of pre-commissioning checks.
- D. Test Reports: Completed pre-commissioning checklists and functional performance test checklists organized by system and by subsystem and submitted as one package. The results of failed tests shall be included along with a description of the corrective action taken.

1.4 SEQUENCE AND SCHEDULING

- A. The work described in this section shall begin only after all work required in related Sections, including Section 23 05 93 – Testing and Balancing Air and Water Distribution Systems and Section 23 09 00 – Facility Management and Direct Digital Control System, has been

successfully completed, and all test and inspection reports and operation and maintenance manuals required in these Sections have been submitted and approved.

- B. The contractor is responsible for all start-up and initial check-out procedures for equipment furnished in this project and for calibration of all sensors and actuators. The contractor must certify that all equipment is fully functional prior to the beginning of any commissioning activities.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 COMMISSIONING TEAM AND CHECKLISTS

- A. The Contractor shall designate team members to participate in the pre-commissioning checks and the functional performance testing specified herein. The team members shall be as follows:
 - 1. Designation Function:
 - M Contractor's Mechanical Representative
 - E Contractor's Electrical Representative
 - T Contractor's Testing, Adjusting, and Balancing Representative
 - C Contractor's Controls Representative
 - CA Commissioning Agent
 - 2. Each checklist shown in appendices A and B shall be completed by the commissioning team. Acceptance by each commissioning team member of each pre-commissioning checklist item shall be indicated by initials and date unless an "X" is shown indicating that participation by that individual is not required. Acceptance by each commissioning team member of each functional performance test checklist shall be indicated by signature and date.
 - 3. The Design Agent's Representative's role in the process shall be to coordinate resolution of any system deficiencies that are identified during the commissioning process.

3.2 TESTS

- A. The pre-commissioning checks and functional performance tests shall be performed in a manner which essentially duplicates the checking, testing, and inspection methods established in the related Sections. Where checking, testing, and inspection methods are not specified in other Sections, methods shall be established which will provide the information required. Testing and verification required by this section shall be performed during the Commissioning phase. Requirements in related Sections are independent from the requirements of this Section and shall not be used to satisfy any of the requirements specified in this Section. The Contractor shall provide all materials, services, and labor required to perform the pre-commissioning checks and functional performance tests. A pre-commissioning check or functional performance test shall be aborted if any system deficiency prevents the successful completion of the test or if any participating commissioning team member of which

participation is specified is not present for the test. The Contractor shall reimburse the Owner for all costs associated with effort lost due to tests that are aborted.

B. Pre-commissioning Checks:

1. Pre-commissioning checks shall be performed for the items indicated on the checklists in Appendix A. Deficiencies discovered during these checks shall be corrected and retested in accordance with the applicable contractor requirements.
2. An approved HVAC Commissioning Report shall be completed at the end of the process listing the correction of all deficiencies. A copy of this report shall be turned over to the owner and the Building Inspector prior to building occupancy.

C. Functional Performance Tests:

1. Functional performance tests shall be performed for the items indicated on the checklists in Appendix B. Functional tests shall begin only after all pre-commissioning checks have been successfully completed. Tests shall prove all modes of the sequences of operation and shall verify all other relevant contract requirements. Tests shall begin with equipment or components and shall progress through subsystems to complete systems. Upon failure of any functional performance test checklist item, the Contractor shall correct all deficiencies in accordance with the applicable contract requirements. The checklist shall then be repeated until it has been completed with no errors.

END OF SECTION 23 08 00

APPENDIX A

PRE-COMMISSIONING CHECKLISTS

Pre-Commissioning checklist – Piping

For Chilled Water Piping Systems

Checklist Item	M	E	T	C	CA
Installation					
a. Piping complete.	___	X	___	X	___
b. As-built shop drawings submitted.	___	X	___	X	___
c. Piping flushed and cleaned.	___	X	___	X	___
d. Strainers cleaned.	___	X	___	X	___
e. Valves installed as required.	___	X	___	X	___
f. Piping insulated as required.	___	X	___	X	___
g. Thermometers and gauges installed as required.	___	X	___	X	___
h. Verify operation of valves.	___	X	___	___	___
i. Air vents installed as specified.	___	X	X	X	___
j. Flexible connectors installed as specified.	___	X	X	X	___
k. Verify that piping has been labeled and valves identified as specified.	___	X	___	___	___
Testing, Adjusting, and Balancing (TAB)					
a. Hydrostatic test complete.	___	X	___	___	___
b. TAB operation complete.	___	X	___	___	___

Pre-Commissioning Checklist – Ductwork

For Air Handler: All Units

Checklist Item	M	E	T	C	CA
Installation					
a. Ductwork complete.	___	X	___	X	___
b. As-built shop drawings submitted.	___	X	___	X	___
c. Ductwork leak test complete.	___	X	___	X	___
d. Fire dampers, and access doors installed as required.	___	X	___	X	___
e. Ductwork insulated as required.	___	X	___	X	___
f. Thermometers and gauges installed as required.	___	___	___	___	___
g. Verify open/closed status of dampers.	___	X	___	X	___
h. Verify smoke dampers operation.	___	X	___	___	___
i. Flexible connectors installed as specified.	___	X	___	X	___
Testing, Adjusting, and Balancing (TAB)					
a. TAB operation complete.	___	X	___	X	___

Pre-Commissioning Checklist – Variable Volume Air Handling Unit

For Air Handling Unit: AHU#1

Checklist Item	M	E	T	C	CA
Installation					
a. Vibration isolation devices installed.	___	X	X	X	___
b. Inspection and access doors are operable and sealed.	___	X	___	X	___
c. Casing undamaged.	___	X	X	X	___
d. Insulation damaged.	___	X	X	X	___
e. Condensate drainage is unobstructed. (Visually verify drainage by pouring a cup of water into drain pan.)	___	X	X	X	___
f. Fan belt adjusted.	___	X	___	X	___
g. Manufacturer’s required maintenance clearance provided.	___	X	X	X	___
Electrical					
a. Power available to unit disconnect.	___	___	X	X	___
b. Power available to unit control panel.	___	___	X	___	___
c. Proper motor rotation verified.	___	___	___	X	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	X	___	___
Coils					
a. Chilled water piping properly connected.	___	X	X	X	___
b. Chilled water piping pressure tested.	___	X	X	X	___

Checklist Item	M	E	T	C	CA
a. Air vents installed on water coils with shutoff valves.	___	X	X	X	___
b. Any damage to coil fins has been repaired.	___	X	___	X	___
Controls					
a. Control valves/actuators properly installed.	___	X	___	___	___
b. Control valves/actuators operable.	___	X	___	___	___
c. Dampers/actuators properly installed.	___	X	___	___	___
d. Dampers/actuators operable.	___	X	___	___	___
e. Verify proper location, installation and calibration of duct static pressure sensor.	___	X	___	___	___
f. Fan air volume controller operable.	___	X	___	___	___
g. Air handler controls system operational.	___	X	___	___	___
Testing, Adjusting, and Balancing (TAB)					
a. Construction filters removed and replaced.	___	X	___	___	___
b. TAB report submitted.	___	X	___	X	___
c. TAB results within +10%/-0% of cfm shown on drawings.	___	X	___	___	___
d. TAB results for outside air intake within +10%/-0% of both the minimum and maximum cfm shown on drawings.	___	X	___	X	___

Pre-Commissioning Checklist – VAV Terminal Unit

For VAV Terminal: All Terminal Units

Checklist Item	M	E	T	C	CA
Installation					
a. VAV terminal in place.	___	X	X	X	___
b. VAV terminal ducted.	___	X	X	X	___
c. VAV terminal connected to controls.	___	X	X	___	___
d. Reheat coil connected to hot water pipe.	___	X	___	X	___
e. Manufacturer's required maintenance clearance provided.	___	X	X	X	___
Controls					
a. Reheat VAV terminal controls set.	___	X	X	___	___
b. Reheat terminal/coil controls verified.	___	X	X	___	___
Testing, Adjusting, and Balancing (TAB)					
a. Verify terminal maximum air flow set.	___	X	___	___	___
b. Verify terminal minimum air flow set.	___	X	___	___	___
c. TAB operation complete.	___	X	___	X	___

Pre-Commissioning Checklist – Pumps

For Pump: Chilled Water

Checklist Item	M	E	T	C	CA
Installation					
a. Pumps grouted in place.	___	X	X	X	___
b. Pump vibration isolation devices functional.	___	X	X	X	___
c. Pump/motor coupling alignment verified.	___	X	X	X	___
d. Piping system installed.	___	X	X	X	___
e. Piping system pressure tested.	___	X	X	X	___
f. Pump not leaking.	___	X	X	X	___
g. Field assembled couplings aligned to meet manufacturer's prescribed tolerances.	___	X	X	X	___
Electrical					
a. Power available to pump disconnect.	___	___	X	X	___
b. Pump rotation verified.	___	___	X	X	___
c. Control system interlocks functional.	___	___	X	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	X	___	___
Testing, Adjusting, and Balancing (TAB)					
a. Pressure/temperature gauges installed.	___	X	___	X	___
b. Piping system cleaned.	___	X	X	X	___
c. Chemical water treatment complete.	___	X	X	X	___
d. Water balance complete.	___	X	___	X	___
e. Water balance with design maximum flow.	___	X	___	X	___
f. TAB Report submitted.	___	X	___	X	___

Pre-Commissioning Checklist – Electric Unit Heater

For Electric Unit Heater: EUH#1

Checklist Item	M	E	T	C	CA
Installation					
a. Manufacturer’s required maintenance/operational clearance provided.	___	X	X	X	___
Electrical					
a. Power available to unit disconnect.	___	___	X	___	___
b. Proper motor rotation verified.	___	___	X	X	___
c. Verify that power disconnect is located within sight of the unit it controls.	___	___	X	___	___
d. Power available to electric heating coil.	___	___	X	___	___
Controls					
a. Verify proper location and installation of thermostat.	___	X	___	___	___
Testing, Adjusting, and Balancing (TAB)					
a. TAB Report submitted.	___	X	___	X	___

Pre-Commissioning Checklist – Exhaust Fan

For Exhaust Fans: All

Checklist Item	M	E	T	C	CA
Installation					
a. Fan belt adjusted.	___	X	___	X	___
b. Speed controller installed.	___	X	___	X	___
Electrical					
a. Power available to fan disconnect.	___	___	X	___	___
b. Proper motor rotation verified.	___	___	___	X	___
c. Verify that power disconnect is located Within sight of the unit it controls.	___	___	X	___	___
Controls					
a. Control interlocks properly installed.	___	___	X	___	___
b. Control interlocks operable.	___	___	X	___	___
c. Dampers/actuators properly installed.	___	X	___	___	___
d. Dampers/actuators operable.	___	X	___	___	___
e. Verify proper locations and installation of thermostat.	___	X	___	___	___
Testing, Adjusting, and Balancing (TAB)					
a. TAB results –10%/-0% to cfm shown on drawings.	___	X	___	X	___
b. TAB Report submitted.	___	X	___	X	___

Pre-Commissioning Checklist – Packaged Air-Cooled Chiller

For Chiller: All

Checklist Item	M	E	T	C	CA
Installation					
a. Chiller properly piped.	___	X	___	___	___
b. Chilled water pipe leak tested.	___	X	X	X	___
c. Verify that refrigerant used complies with specified requirements.	___	X	X	X	___
d. Any damage to coil fins has been repaired.	___	X	___	X	___
e. Manufacturer’s required maintenance clearance provided.	___	X	X	X	___
Electrical					
a. Power available to unit disconnect.	___	___	X	___	___
b. Power available to unit control panel.	___	___	X	___	___
c. Separate power is supplied to electric heating tape.	___	___	X	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	X	___	___
Controls					
a. Factory startup and checkout complete.	___	X	X	___	___
b. Chiller safety/protection devices tested.	___	X	X	___	___
c. Chilled water flow switch installed.	___	X	X	___	___
d. Chilled water flow switch tested.	___	X	X	___	___
e. Chilled water pump interlock installed.	___	X	X	X	___
f. Chilled water pump interlock tested.	___	___	X	___	___

Pre-Commissioning Checklist – HVAC System Controls

For HVAC System: All

Checklist Item	M	E	T	C	CA
Installation					
a. As-built shop drawings submitted.	___	X	X	___	___
b. Layout of control panel matches drawings.	___	X	X	___	___
c. Framed instructions mounted in or near control panel.	___	X	X	___	___
d. Components properly labeled (on inside and outside of panel).	___	X	X	___	___
e. Control components piped and/or wired to each labeled terminal strip.	___	X	X	___	___
f. EMCS connection made to each labeled terminal strip as shown.	___	X	X	___	___
g. Control wiring and tubing labeled at all terminations, splices, and junctions.	___	X	X	___	___
h. Shielded wiring used on electronic sensors.	___	X	X	___	___
Main Power and Control Air					
a. 110 volt AC power available to panel.	___	___	X	___	___
Testing, Commissioning, and Balancing					
a. Testing, Commissioning, and Balancing Report submitted.	___	X	___	___	___

Pre-Commissioning Checklist – Split System DX Unit

For Split System DX Unit: DAHU/DHPU#1

Checklist Item	M	E	T	C	CA
Installation					
a. Condensing unit in place with recommended service/air clearances.	___	X	X	X	___
b. Condensing unit piped.	___	X	X	X	___
c. Refrigerant pipe leak tested.	___	X	X	X	___
Electrical					
a. Power available to unit disconnect.	___	___	X	X	___
b. Power available to unit control panel.	___	___	X	___	___
Controls					
a. Unit safety/protection devices tested.	___	X	X	___	___
b. Control system and interlocks installed.	___	X	X	___	___
c. Control system and interlocks operational.	___	X	X	___	___

APPENDIX B

FUNCTIONAL PERFORMANCE TESTS CHECKLISTS

Functional Performance Test Checklist – Pumps

For Pump: All

Prior to performing this checklist, ensure that for closed loop systems, system is pressurized and the make-up water system is operational or, for open loop systems, that the sumps are filled to the proper level.

1. Activate pump start using control system commands (all possible combination, on/auto, etc.).
ON _____ AUTO _____ OFF _____

- a. Verify pressure drop across strainer:

Strainer inlet pressure _____ psig
Strainer outlet pressure _____ psig

- b. Verify pump inlet/outlet pressure reading, compare to Testing, Adjusting, and Balancing (TAB) Report, pump design conditions, and pump manufacturer's performance.

	DESIGN	SYSTEM TEST	ACTUAL
Pump inlet pressure (psig):	_____	_____	_____
Pump outlet pressure (psig):	_____	_____	_____

- c. Operate pump at shutoff and 100 percent of designed flow when all components are in full flow. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 Percent
Pump inlet pressure (psig):	_____	_____
Pump outlet pressure (psig):	_____	_____
Pump flow rate (gpm):	_____	_____

- d. Operate pump at shutoff and at minimum flow or when all components are in full by-pass. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 Percent
Pump inlet pressure (psig):	_____	_____
Pump outlet pressure (psig):	_____	_____
Pump flow rate (gpm):	_____	_____

2. Verify motor amperage each phase and voltage phase to phase and phase to ground for both the full flow and the minimum flow conditions.

a. Full flow:

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage	_____	_____	_____
Voltage	_____	_____	_____
Voltage to ground	_____	_____	_____

b. Minimum flow:

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage	_____	_____	_____
Voltage	_____	_____	_____
Voltage to ground	_____	_____	_____

3. Unusual vibration, notes, etc.

4. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting, and
Balancing Representative _____

Contractor's Controls Representative _____

Commissioning Agent _____

Functional Performance Test Checklist – Variable Air Volume Air Handling Unit

For Air Handling Unit: _____

Ensure that a slight negative pressure exists on the inboard side of the outside air dampers throughout the operations of the dampers. Modules OA, RA, and EA dampers from fully open to fully closed positions.

1. Functional Performance Test: Contractor shall verify operation of air handling unit as per specification including the following:

a. The following shall be verified when the supply fan operating mode is initiated:

- 1) All dampers in normal position. _____
- 2) All valves in normal position. _____
- 3) System safeties allow start if safety conditions are met. _____
- 4) VAV fan controller shall “soft-start” fan. _____
- 5) Modulate all VAV boxes to minimum air flow and verify that the static pressure does not exceed the design static pressure Class shown.

b. Unoccupied mode of operation:

- 1) All dampers in normal position. _____
- 2) Verify low limit space temperature is maintained as specified in sequence of operation. _____

c. The following shall be verified when the supply and return fans off mode is initiated:

- 1) All dampers in normal position. _____
- 2) All valves in normal position. _____
- 1) Fan de-energizes. _____

d. Verify the chilled water coil control valve operation by setting all VAV’s to maximum and minimum cooling.

	Max cooling	Min cooling
Supply air volume (_____ cfm)	_____	_____
Supply air temp. (_____ degrees F)	_____	_____

- e. Verify safety shut down initiated by smoke detectors. _____
- f. Verify safety shut down initiated by low temperature protection thermostat.

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirement in this section of the specifications.

Signature and Date

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting, and
Balancing Representative _____

Contractor's Controls Representative _____

Commissioning Agent _____

Functional Performance Test Checklist – Electric Unit Heater

For Electric Unit Heater:

1. Functional Performance Test: Contractor shall verify operation of electric unit heater as per specification including the following:
 - a. The following shall be verified when the fan operating mode is initiated:
 - 1) Electric heating coil energizes. _____
 - 2) System safeties allow start if safety conditions are met. _____
 - 3) Verify space temperature is maintained as specified in sequence of operation.

 - 4) Fan energizes (supply cfm): _____
 - b. The following shall be verified when the supply fan off mode is initiated:
 - 1) Fan de-energizes. _____
 - 2) Electric heating coil de-energizes. _____
2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's Testing, Adjusting, and Balancing Representative	_____
Contractor's Controls Representative	_____
Commissioning Agent	_____

Functional Performance Test Checklist – Exhaust Fans

For Exhaust Fans: All

1. Functional Performance Test: Contractor shall verify operation of fans as per specification including the following:
 - a. The following shall be verified when the supply or exhaust fan operating mode is initiated:
 - 1) Fan motor energizes. _____
 - 2) System safeties allow start if safety conditions are met. _____
 - 3) Fan provides design cfm. _____
 - b. The following shall be verified when the supply or exhaust fan off mode is initiated:
 - 1) Fan de-energizes. _____
2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Chief Quality Control Representative	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's Testing, Adjusting, and Balancing Representative	_____
Contractor's Controls Representative	_____
Commissioning Agent	_____

Functional Performance Test Checklist – DX Air Cooled Condensing Unit

For Condensing Unit: _____

1. Functional Performance Test: Contractor shall demonstrate operation of refrigeration system as per specifications including the following: Start building air handler to provide load for condensing unit. Activate controls system chiller start sequence as follows:
 - a. Start Air Handling Unit. Verify control system energizes condensing unit start sequence.

 - b. Shut-off air handling equipment to verify condensing unit de-energizes.

 - c. Restart air handling equipment one minute after condensing unit shut down. Verify condensing unit restart sequence. _____

2. Verify condensing unit amperage each phase and voltage phase to phase and phase to ground.

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage	_____	_____	_____
Voltage	_____	_____	_____
Voltage to ground	_____	_____	_____

3. Record the following information:
Ambient Temperature _____ F.
4. Check and report usual vibration, noise, etc.

5. Results:
 - a. Contractor shall record and submit results obtained in items 1, 2, 3, and 4 above to the contracting officer.

6. If specified equipment performance is not verified, contractor shall report remedial action required and re-schedule Functional Performance Test.

7. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Mechanical Representative

Contractor's Electrical Representative

Contractor's Testing, Adjusting, and
Balancing Representative

Contractor's Controls Representative

Commissioning Agent

Functional Performance Test Checklist – VAV Terminals

For VAV Air Terminal Units: All

The Owner’s Representative will select VAV terminals to be spot-checked during the functional performance test. The number of terminals shall not exceed 10 percent.

1. Functional Performance Test: Contractor shall demonstrate operation of selected VAV boxes as per specifications including the following:

2. Cooling with reheat VAV boxes:

- 2) Verify VAV box response to room temperature set point adjustment.
Turn thermostat to 5 degrees F above ambient and measure maximum air flow.
Turn thermostat to 5 degrees F above ambient and measure minimum air flow.

Maximum flow	cfm
Minimum flow	cfm

3) Check damper maximum/minimum flow settings.

Maximum flow	cfm
Minimum flow	cfm

Reheat coil operation range (full open to full closed) _____

3. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specification.

Signature and Date

Contractor’s Mechanical Representative _____

Contractor’s Electrical Representative _____

Contractor’s Testing, Adjusting, and Balancing Representative _____

Contractor’s Controls Representative _____

Commissioning Agent _____

Functional Performance Test Checklist – Variable Air Volume Air Handling Unit

For Air Handling Unit: AHU #1

Ensure that a slight negative pressure exists on the inboard side of the outside air dampers throughout the operations of the dampers. Modules OA, RA, and EA dampers from fully open to fully closed positions.

1. Functional Performance Test: Contractor shall verify operation of air handling unit as per specification including the following:

a. The following shall be verified when the supply fan operating mode is initiated:

- 1) All dampers in normal position. _____
- 2) All valves in normal position. _____
- 3) System safeties allow start if safety conditions are met. _____
- 4) VAV fan controller shall “soft-start” fan. _____
- 5) Modulate all VAV boxes to minimum air flow and verify that the static pressure does not exceed the design static pressure Class shown.

b. Unoccupied mode of operation:

- 6) All dampers in normal position. _____
- 7) Verify low limit space temperature is maintained as specified in sequence of operation. _____

c. The following shall be verified when the supply and return fans off mode is initiated:

- 1) All dampers in normal position. _____

d. All valves in normal position. _____

- 1) Fan de-energizes. _____

e. Verify the chilled water coil control valve operation by setting all VAV’s to maximum and minimum cooling.

	Max cooling	Min cooling
Supply air volume (____ cfm)	_____	_____
Supply air temp. (____ degrees F)	_____	_____

- f. Verify safety shut down initiated by smoke detectors. _____
- g. Verify safety shut down initiated by low temperature protection thermostat.

- h. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirement in this section of the specifications.

Signature and Date

Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's Testing, Adjusting, and Balancing Representative	_____
Contractor's Controls Representative	_____
Commissioning Agent	_____

Functional Performance Test Checklist – Packaged Air Cooled Chiller

For Chiller:

1. Functional Performance Test: Contractor shall demonstrate operation of chilled water system as per specifications including the following: Start building air handler to provide load for chiller. Activate controls system chiller start sequence as follows:
 - a. Start chilled water pump and establish chilled water flow. Verify chiller-chilled water proof-of-flow switch operation. _____
 - b. Verify control system energizes chiller start sequences. _____
 - c. Verify chiller senses chilled water temperature above set point and control system activates chiller start. _____
 - d. Verify functioning of “soft start” sequence. _____
 - e. Shut off air handling equipment to remove load on chilled water system. Verify chiller shutdown sequence is initiated and accomplished after load is removed. _____
 - f. Restart air handling equipment on minute after chiller shut down. _____

Signature and Date

Contractor’s Mechanical Representative	_____
Contractor’s Electrical Representative	_____
Contractor’s Testing, Adjusting, and Balancing Representative	_____
Contractor’s Controls Representative	_____
Commissioning Agent	_____

Functional Performance Test Checklist – Packaged Air Cooled Chiller

For Chiller:

1. Verify chiller restart sequence. _____
2. Verify chiller inlet/outlet pressure reading, compare to Testing, Adjusting, and Balancing (TAB) Report, chiller design conditions, and chiller manufacturer’s performance data.

	DESIGN	SYSTEM TEST	ACTUAL
Chiller inlet pressure (psig):	_____	_____	_____
Chiller outlet pressure (psig):	_____	_____	_____

3. Verify chiller amperage each phase and voltage phase-to-phase and phase-to-ground.

	PHASE 1	PHASE 2	PHASE 3
Amperage	_____	_____	_____
Voltage	_____	_____	_____
Voltage	_____	_____	_____
Voltage to ground	_____	_____	_____

4. Record the following information:

Ambient dry bulb temperature _____ degrees F
 Ambient wet bulb temperature _____ degrees F
 Entering chilled water temperature _____ degrees F
 Leaving chilled water temperature _____ degrees F

5. Unusual vibration, noise, etc.

6. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor’s Mechanical Representative _____

Contractor’s Electrical Representative _____

Contractor’s Testing, Adjusting, and Balancing Representative _____

Contractor’s Controls Representative _____

Commissioning Agent _____

SECTION 23 09 00 - FACILITY MANAGEMENT AND DIRECT DIGITAL CONTROL SYSTEM

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 OVERVIEW

- A. Furnish all labor, materials, equipment, and service necessary for a complete and operating temperature control system, utilizing Direct Digital Controls, electronic interfaces and actuation devices, as shown on the drawings and as described herein.
- B. The graphic interface shall include a graphic image of each component including real time data for each control point. All software and hardware necessary for the owner to properly view and interface with the graphics and control system shall be provided.
- C. All labor, material, equipment and software necessary to meet the functional intent of the system, as specified herein and as shown on the drawings, shall be included. Drawings are diagrammatic only. Equipment and labor not specifically referred to herein or on the plans, that are required to meet the functional intent, shall be provided without additional cost to the Owner.
- D. The DDC control system shall be an independent system with web interface for remote access and set. The system shall be Automated Logic, Siemens, Honeywell, Trane, Johnson Controls or Schneider Electric. Products shall be manufactured conform to ASHRAE Standard 135-2016, BACnet. If the DDC system is proposed by the same manufacturer as the HVAC equipment, then the DDC price shall be listed as a separate line item. Prices lumped together with equipment costs will not be accepted.

1.3 INSTALLATION

- A. All work described in this section shall be installed, wired, circuit tested and calibrated by factory trained electricians and mechanics qualified for this work and in the regular employment of the temperature control system manufacturer or its exclusive factory authorized installing contracting field office (representative). The installing office shall have a minimum of five years of installation experience with the manufacturer and shall provide documentation in submittal package verifying longevity of the installing company's relationship with the manufacturer. Installation shall not be subcontracted. Supervision, calibration and checkout of the system shall be by the employees of the local exclusive factory authorized temperature control contracting field office (branch or representative). The employees of the installing office shall be factory trained with training certification documentation provided in submittal package.

- B. All temperature control and interlock wiring, where exposed or in wall structure, shall be installed in conduit or as otherwise shown on the plans. Where concealed in Plenum or Chase, plenum rated wiring can be used and shall be installed with appropriate wire hangers or with other wiring bundles. Power wiring shall be run in separate conduit from sensor or communication wiring.

1.4 SYSTEM PERFORMANCE

- A. Performance Standards: The system as a minimum shall conform to the following:
 1. Graphic Display: The system shall display a graphic with all current data within 10 seconds.
 2. Graphic Refresh: The system shall update a graphic with dynamic points with all current data within 8 seconds.
 3. Object Command: The maximum time between the command of a binary point by the operator and the reaction by the device shall be less than 2 seconds. Analog objects should start to adjust within 2 seconds.
 4. Object Scan: All changes of state and change of analog values will be transmitted over the high speed network such that any data used or displayed at a controller or workstation will have been current within the previous 60 seconds.
 5. Alarm Response Time: The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 30 seconds.
 6. Program Execution Frequency: applications shall be capable of running as often as once every 5 seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
 7. Performance: Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency of at least once per second. The controller shall scan and update the process value and output generated by this calculation at the same frequency.
 8. Multiple Alarm Annunciation: All workstations on the network must receive alarms within 5 seconds of each other.
 9. Reporting Accuracy: The system shall report all values with an end-to-end accuracy as listed or better than those listed in Table 1.
 10. Stability of Control: Control Loops shall maintain measured variables at set point within the tolerances listed in Table 2.

TABLE 1: Reporting Accuracy	
Measured Variable	Reported Accuracy
Space Temperature	±0.5°C [±1°F]
Ducted Air	±0.5°C [±1°F]
Outside Air	±0.5°C [±2°F]
Dew Point	±1.5°C [±3°F]
Water Temperature	±0.5°C [±1°F]
Delta-T	±0.15°C [±0.25°F]
Relative Humidity	±3% RH
Water Flow	±5% of Full Scale

Airflow (Terminal)	±10% of Full Scale (See Note 1)
Airflow (Measuring Stations)	±5% of Full Scale
Air Pressure (Ducts)	±25 Pa [±0.1" W.G.]
Air Pressure (Space)	±3 Pa [±0.1" W.G.]
Water Pressure	±2% of Full Scale (See Note 2)
Electrical	5% of Full Reading (See Note 3)
	(A,V,W, Power Factor)
Carbon Monoxide (CO)	±5% of Reading (See Note 3)
Carbon Dioxide (CO2)	±50 ppm

Note 1: 10%-100% of scale.

Note 2: For both absolute and differential pressure

Note 3: Not including utility-supplied meters

Table 2: Control Stability and Accuracy

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±50 Pa [±0.2" w.g.]	0-1.5 kPa [0-6" w.g.]
	±3 Pa [±0.1" w.g.]	-25 to 25 kPa [-0.1 to 0.1" w.g.]
Airflow	±100 CFM	
Temperature	±0.5°C [±1.0°F]	
Humidity	±3% RH	
Fluid Pressure	±10 kPa [±1.5 psi]	0-1 kPa'1-150 psi]
	±250 kPa [±1.0" w.g.]	0-12.5 kPa [0-50" w.g.]

1.5 SHOP DRAWINGS/SUBMITTALS

- A. Eight copies of shop drawings of the entire control system shall be submitted and shall consist of a complete list of equipment and materials, including manufacturer's catalog data sheets and installation instructions. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings. A complete written Sequence of Operation as well as a hard copy graphical depiction of the application control programs shall also be included with the submittal package.
- B. Upon completion of the work, provide a complete set of drawings and application software on magnetic floppy disk media. Drawings shall be provided as AutoCad compatible files.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. All materials and equipment used shall be standard components, of regular manufacture for this application. All systems and components shall have been thoroughly tested and proven in actual use. Only products manufactured by Siemens shall be considered acceptable. Communication involving control components shall conform to ASHRAE Standard 135-1995, BACnet.

2.2 SENSORS

- A. Room Sensor: Resistance sensor with setpoint adjustment. Provide with LCD digital display. Provide with RJ-11 outlet for communication. Each room sensor shall be provided with a momentary pushbutton with indicator for override of unoccupied operation. Each room thermostat shall have an integral momentary pushbutton which can be depressed by the occupant during unoccupied mode. Pushbutton shall cause the Local Direct Digital controller to bring the air handler to occupied setpoints for a period of up to 2 hours (adjustable). Should occupant depress pushbutton again later, the controller shall begin timing an additional override period: Multiple pushes of the override button shall NOT cause an accumulation of override time.
- B. Outside Air Sensor: Epoxy encased sensor protected by sunshield.
- C. Humidity Sensor: Solid state transmitter with built-in non-organic sensor for space and return air sensing, 20 - 80% RH range.
- D. Carbon Dioxide Sensor: Non-dispersive infrared (NDIR), wall mounted carbon dioxide sensor without LCD display. Sensing range shall be an adjustable 0 – 2000 ppm. Analog current output shall be 0-10 Vdc or 4-20 Ma (selectable). Sensor shall be gold-plated. Power shall be 24 Vac. Minimum sensor accuracy shall be 5%. Unit shall include automatic background calibration (ABC) algorithms. Unit shall be equal to Honeywell C7232A.

2.3 SAFETY CONTROLS

- A. Duct Mounted Smoke Detector: Refer to Electrical Division.
- B. Firestat: Electric; snap action; manual reset; mount as indicated in Sequence of Operation. Setpoints: RA-125° F; S.A.-160° F, unless in variance with Code or 50° F above normal operating temperature.

2.4 CONTROL DAMPERS

- A. Construction: Heavy-duty commercial quality, opposed action dampers; reinforced galvanized steel or aluminum blades, 6-inch minimum width, 8-inch maximum width; 16 gauge, minimum, galvanized steel or 1/8-inch thick, minimum, extruded aluminum for single

thickness, 22 gauge, minimum, galvanized steel or 1/8-inch wall thickness extruded aluminum for double thickness; steel shafts with non-corrosive plating; oilite bearings; 13 gauge, galvanized steel, minimum, or 1/8-inch thick aluminum, minimum, structural frames with inside dimension of frame equal to duct lining (if any); corrosion resistant finish unless otherwise noted. Multiple damper assemblies shall be provided with 1-inch minimum jackshaft assembly. Blade linkage shall be outside of airstream.

- B. Gasketing: Rubber or extruded vinyl blade edge and end seals to limit leakage to 10 CFM/S.F. at 4-inch w.g. static pressure. Foam or sponge type gasketing is not acceptable.
- C. Design:
 - 1. Minimum OSA: 4000 fpm face velocity rating; two-position or modulating as scheduled; N.C.
 - 2. Maximum OSA: 4000 fpm rating; modulating; N.C.
 - 3. Return Air: 4000 fpm rating; modulating; N.O.
 - 4. Exhaust Air: 4000 fpm rating; modulating; N.C.
- D. Sizes: Sizes shall be as shown. Dampers and damper assembly construction shall be rated for the face velocity ratings specified.
- E. Cut slot on damper shaft to indicate damper blade position and provide bakelite nameplate to indicate "Closed" and "Open" positions.

2.6 CONTROL CABINET

- A. Construction: Totally enclosed; 16 gauge steel minimum, 14 gauge aluminum minimum; with locking door; two keys; baked enamel finish. Provide NEMA-1 enclosure indoors and NEMA-4X enclosure outdoors.
- B. Mounting: Wall; top of cabinet maximum 6'-6" above floor; bottom of cabinet minimum 2'-6" above floor.
- C. Wiring: Color coded; both ends of conductors identified with manufactured alphanumeric tags keyed to termination points; connections and junctions at instruments and terminal strips only; conductors in wire troughs or laced with waxed cord; crimp-on terminal connectors. Wiring and devices that derive power from starters and other sources shall be located within an isolated compartment and provided with a separate terminal strip.
- D. Nameplates: All devices; bakelite with white letters indicating device description and designation number (i.e., pneumatic electric switch P.E.-5).
- E. Electrical Isolation: Provide isolation transformers and surge protection on panel power supplies. Provide lightning arresters on any outdoor wiring or exterior communication/modem lines. Ground path from protection devices to building ground shall not exceed 0.5 OHMS impedance, minimum #6 AWG stranded copper conductor. Cover all line voltage terminations within panel.

- F. Instruments: All instruments and controls controlling equipment within the mechanical rooms shall be installed within control cabinets in the mechanical room where possible. Controls shall not be scattered around the room or walls or equipment.

2.7 AC MOTOR VARIABLE FREQUENCY CONTROLLERS

- A. Variable frequency drives (VFDs) shall be manufactured by Franklin, ABB or Yaskawa and provided for variable air volume air handling units and variable volume pumps. Each variable torque AC drive shall consist of an adjustable frequency controller capable of driving a standard high efficiency AC induction motor. Variable frequency drive shall be housed in an all steel hinged NEMA-1 enclosure when installed indoors and a NEMA 3R enclosure when installed outdoors.
- B. The VFD shall include a full-wave diode bridge rectifier. VFD shall maintain .95 displacement power factor regardless of speed or load.
- C. The inverter section of the VFD shall be sine-coded pulse width modulated (PWM). The VFD shall incorporate the use of IGBTs to reduce motor noise. VFDs incorporating Darlingtion transistors shall provide output line reactors.
- D. The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD, including all specified options, shall be listed by a nationally recognized testing agency such as UL, CUL, ETL, or CSA.
- E. Power line noise shall be limited to a voltage distortion factor and line notch depth as defined in IEEE Standard 519-1981, Guide for Harmonic Control and Reactive Compensation of Static Power Converters. The total voltage distortion shall not exceed 5%.
- F. Motor noise as a result of the VFD shall be limited to three dB over across the line operation, measured at three feet from the motor's center line.
- G. The VFD's full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall have a continuous 110% overload rating and a 115% overload rating for 60 seconds.
- H. Protective Features:
 - 1. Individual motor overload protection for each motor controlled.
 - 2. Protection against input power under voltage, over voltage and phase loss, output current overload and instantaneous over current, over temperature within the VFD enclosure, over voltage on the DC bus, output short circuit, and motor winding shorting to case faults.
 - 3. Protect VFD from sustained power or phase loss. The VFD shall incorporate a two second power loss ride through for control circuitry only to eliminate nuisance tripping.
 - 4. The VFD shall incorporate semi-conductor rated fuses for the input. The fuses shall be UL/CSA listed and incorporated in the standard NEMA-1 enclosure. Fuses shall be rated for 200,000 amp interrupting capacity (AIC).

I. Interface Features:

1. Door mounted Hand/Off/Auto selector switch to start and stop the VFD. Provide open collector outputs for remote indication of Hand/Off/Auto.
2. Digital manual speed control. Potentiometers not acceptable.
3. Local/Remote selector switch to determine source speed reference.
4. The VFD shall include the following door mounted status indicators: Power On, Drive Ready, Run, Hand/Off/Auto, Local, Remote, Keypad Lockout On and Reverse.
5. The VFD shall be equipped with a door mounted panel to provide individual fault indications for the following: Under voltage, High Line, Phase Loss, Bus Over voltage, Over current, Ground Fault, Overload, Over temperature, External Fault, and Output Open. Fault codes not acceptable.
6. The VFD shall store in memory the previous three faults.
7. Digital meter with selector switch to indicate the following: Percent Speed, Percent Load, Output Frequency, Input kW, Output Voltage, and Output Current.
8. A set of form-C, dry contacts to indicate when the VFD is in the Run and Fault mode.
9. A 4 to 20 mA output signal to vary in direct proportion to the controller's speed (frequency) and controller's load (amps).
10. VFD to have terminal strip to accept N.C. safety contacts such as freezestats, smoke alarms, etc. VFD to safely shut down in drive or bypass mode when contacts open.
11. VFD to accept an additional N.C. contact to interface with the Hand/Off/Auto switch for remote Stop/Start control.
12. VFD shall accept a direct acting or reverse acting 4 to 20 mA, 0 to 5 Vdc, 0 to 10 Vdc, or a 3 to 15 psi pneumatic signal (if required).
13. The VFD shall have two programmable resonant frequency lockouts with adjustable frequency band widths.
14. The VFD shall be able to start in a rotating load in either direction.

J. Adjustments:

1. Maximum and minimum speed, independently adjustable from 10 to 100% base speed.
2. Acceleration and deceleration time, independently adjustable 2 to 300 seconds with override circuit to prevent nuisance trips if decel time is set too short.
3. Current limit, adjustable 0 to 115%.
4. Overload trip set point that is infinitely variable based upon motor amperage. The overloads in drive and bypass should be factory set for the connected load.
5. Preset speed, activated upon a contact closure.
6. If VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: Line Under voltage, Phase Loss, Bus Over voltage, Over current, Ground Fault, Overload, Over temperature, External Fault, and Motor Open.
7. The automatic reset time shall be programmable.
8. The VFD shall provide a N.O. contact for enable or disable of reversing.

K. Service Conditions:

1. Ambient temperature 32 to 104°F (0 to 40°C).
2. 0 to 95% relative humidity, non-condensing.

3. Elevation to 3,300 feet (1,000 meters) without derating.
4. AC line voltage variation, -10 to +10% of nominal.

L. Special Features and Options:

1. Provide a four-position Drive/Off/Line/Test switch for complete manual bypass and disconnect functions. The manual switch shall be door interlocked and padlockable in the off position. A motor starter shall be provided in the bypass circuit. Mount the bypass in a separate portion of the VFD enclosure with its own door. The VFD and bypass assembly shall carry the UL panel shop listing. Separate bypass panels that require field mounting and wiring are not acceptable.
2. Provide RFI (Radio Frequency Interference) filters to attenuate VFD generated noise.
3. Provide line reactors on the input side of the drive for harmonic suppression.
4. Provide 3-phase output reactor on VFD output to lower the voltage stress applied to motor windings.

M. Quality Assurance:

1. To ensure quality and minimize infantile failures at the job site, the complete VFD shall be tested by the manufacturer. The VFD shall operate a dynamometer at full load and the load and speed shall be cycled during the test.
2. All optional features shall be functionally tested at the factory for proper operation.

N. Submittals:

1. Submit manufacturer's performance data including dimensional drawings, power circuit diagrams, installation and maintenance manuals, warranty description, VFD's FLA rating, certification agency file numbers, and catalog information.
2. The specification lists the minimum VFD performance requirements for this project. Each supplier shall list any exceptions to the specification. If no departures from the specifications are identified, the supplier shall be bound by the specification.

O. Variable Frequency Drive Start-up:

1. The manufacturer shall provide start-up commissioning of the variable frequency drive and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. The commissioning personnel shall be the same personnel that will provide the factory service and warranty repairs at the customer's site. Sales personnel and other agents who are not factory certified technicians for VFD field repair shall not be acceptable as commissioning agents.
2. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options, and its interface wiring to the building automation system. Start-up shall include customer operator training at the time of the equipment commissioning.
3. Warranty: The VFD shall be warranted by the manufacturer for a period of 36 months from date of shipment. The warranty shall include parts, labor, travel costs, and living expenses incurred by the manufacturer to provide factory authorized on-site service.

- P. Acceptable Manufacturers: Manufacturers acceptable are Honeywell, Graham, Yaskawa, and ABB or approved equal subject to ten (10) day prior approval.
- Q. Warranty: Provide VFD warranty, for one year from date of start-up, not to exceed 18 months from date of shipping. Warranty shall include parts and labor.

2.8 SMOKE DETECTORS

- A. Detectors and wiring are specified in Electrical Division. Installation in ducts is specified in Mechanical Division. Signal for fan shutdown shall be obtained from fire alarm panel for control system input.

2.9 CONTROL VALVES

- A. Control valves shall be three-way pattern. Valves shall be fully modulating with equal percentage ports. The fail position of the valves shall be open.
- B. Valves with size up to and including 3" shall be "screwed" with 250 psi ANSI pressure body rating; 4" and larger valves shall be 'flanged' configuration.
- C. Proportional control valves shall be sized for a maximum pressure drop of 4.0 psig at rated flow (except as noted).

2.10 IN-LINE WATER FLOW METERS:

- A. In-line water flow meters shall be Badger M2000 electromagnetic meters with 24V DC power supply and 4-20mA analog output signal.

2.11 DAMPER ACTUATORS

- A. Electric damper actuators shall be properly sized to provide sufficient torque to position the damper throughout its operating range.

2.12 AIR FLOW MEASURING STATIONS

- A. Ebtron Gold Series GTx116 with a 16 character LCD display that indicates airflow, temperature and system status. The output protocol is BacNet. The system shall be UL873 listed. The minimum warranty is 36 months.

2.13 WARRANTY

- A. The temperature contractor shall provide a one year warranty that will commence from the point of project acceptance by the Owner.

PART 3 - CONTROL DEVICES

3.1 GENERAL

- A. The Building Automation System (BAS) shall be comprised of a network of various independent, Stand-alone Digital Controllers (SDC's), Air Handler Digital Controllers (AHDC's) And Variable Air Volume Digital Controllers (VAVDC's) as specified, to provide centralized access and facility wide control functions. The SDC's, AHDC's, and VAVDC's shall be interconnected in a communicating network to provide facility wide access and sharing of information.
- B. Control networks shall provide either "peer-to-peer", master-slave or supervised token passing (MSTP) communications and shall operate at a minimum communication speed of 9600 baud. The control network shall support digital controllers as indicated in the plans and specifications. The default control network communication protocol shall be BACnet MS/TP Bus Protocol ASHRAE SSPC-135.

3.2 SPECIFICATION NOMENCLATURE:

BAS LAN	Building Automation System Local Area Network
SDC	Standalone Digital Controller
AHDC	Air Handler Digital Controller
VAVDC	Variable Air Volume Digital Controller

3.3 STAND-ALONE DIGITAL CONTROLLERS (SDC)

- A. General
 - 1. Standalone Digital Controller (SDC) shall be 16 bit microcomputer based, utilizing a multi-tasking, multi-user operating system.
 - 2. The SDC controller shall permit the simultaneous operation of all control, communication facilities management and operator interface software, as programmed by the Contractor or User. Modification of the on-board SDC controller database shall be performed on-line using the built-in or HHOT interface. Systems which require the SDC to be removed from service while DDC control sequences are modified shall not be acceptable.
- B. Database and Memory Back-Up
 - 1. All programming defining the functions to be performed by the SDC, including but not limited to application programs and point database within each SDC, shall be protected from loss due to power failure for a minimum of six months. Systems shall utilize non-volatile memory for these functions.

C. Service Ports

1. SDC controllers shall be equipped with a minimum of two operator service ports for the connection of a HHOT. The service ports shall be either a built-in RS-232 data terminal port or an RJ-11 type jack which connects to the manufacturer's standard HHOT.
2. Connection of a service device, to a service port, shall not cause the SDC controller to lose communications with its peers or other networked device controllers.

D. Display and Readout Capability

1. The SDC controller, at a minimum, shall be locally accessed via the HHOT through the local operator service port.
2. The SDC controller shall additionally provide diagnostic LED indication of device transmit and receive data communications for all communication port and peripheral ports, normal operation, abnormal operation and control relay operation indication.

E. Manual/Auto Control and Notification

1. The SDC controller shall provide commanded override capability from the built-in operator interface. Such overrides shall be valid as long as power is applied to the controller.

3.4 AIR HANDLER DIGITAL CONTROLLER (AHDC)

A. General

1. Controls shall be microprocessor based, Air Handler Digital Controllers (AHDC's). AHDC's shall be provided for Air Handling Units and chilled water system. AHDC's shall be based on a minimum 16 bit microprocessor working from software program memory which is physically located in the AHDC. The application control program shall be resident within the same enclosure as the input/output circuitry which translates the sensor signals. All input/output signal conversion shall be performed through a minimum of a 10 bit A to D converter. All input points shall be universal in nature allowing their individual function definition to be assigned through the application software. All unused input points must be available as universally definable at the discretion of the owner. If the input points are not fully universal in nature, unused points must be equal in quantity between Analog Inputs and Digital Inputs.
2. Contractor shall provide a minimum of one AHDC controller per air handling system and chilled water system as shown on the drawings.
3. All input/output signals shall be directly hardwired to the AHDC. Troubleshooting of input/output signals shall be easily executed with a volt-ohm meter (VOM). As a result of this intent, it is specified that power line carrier systems, or other systems which command multiple outputs over a single pair of wires, shall not be utilized.
4. AHDC's shall be in continuous direct communication with the network which forms the facility wide Building Automation System. The AHDC's shall communicate with the SDC at a baud rate of not less than 19,200 baud.

B. Non-Volatile Memory

1. All control sequences programmed into the AHDC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained. Power failures shall not cause the AHDC memory to be lost, nor shall there be any need for batteries to be recharged or replaced to maintain the integrity of the controller database. The AHDC shall allow for the creation of unique application control sequences. Systems that only allow selection of sequences from a library or table, are not acceptable.
2. All control sequences shall be fully programmable at the AHDC, allowing for the creation and editing of an application control sequence, while at the unit.

C. Diagnostics

1. The AHDC shall provide LED indication of transmit/receive communications performance, as well as for the proper/improper operation of the controller itself.

D. Battery

1. The AHDC shall be provided with a battery backed time clock that is capable of maintaining the time of day and calendar for up to thirty days, upon loss of power to the AHDC, without loss of setting. The battery for the time clock shall be replaceable by the customer. The AHDC shall be provided with integral time schedules; as a minimum, two seven day schedules with eight on/off periods per day shall be provided. Holiday override of weekly schedules shall be provided for pre-scheduling of holidays, for the year in advance.

3.5 VARIABLE AIR VOLUME DIGITAL CONTROLLER (VAVDC)

A. General

1. Controls shall be microprocessor based Pressure Independent Variable Air Volume Digital Controllers (VAVDC), as shown in the drawings. The VAVDC shall be based on a microprocessor working from software program memory which is physically located in the VAVDC controller. The VAV controller "intelligence" shall be resident within the same enclosure which translates sensor signals into digital information.
2. The VAVDC shall consist of a microprocessor, power supply, actuator, differential pressure transducer, field terminations, field adjustments and operation/application system software in a single integrated package. All input/output signals shall be directly hardwired to the VAVDC controller. Troubleshooting of input/output signals shall be easily executed through the wall sensor or HHOT connected at the wall sensor location.

B. Non-Volatile Memory

1. All control sequences programmed in the VAV controller shall be stored in non-volatile memory, which is not dependent upon the presence of a battery to be retained. Power failures shall, therefore, not cause the VAV controller memory to be lost, nor shall there

be any need for batteries to be recharged or replaced. The VAVDC shall meet UL-916, FCC Class A, and CSA agency approvals.

C. Room Sensor

1. The VAVDC controller shall have a room sensor with integral room setpoint adjustment. The room sensor/setpoint shall be capable of being shared by up to 31 VAVDC's, providing coordinated control of zones containing multiple VAVDC's. In cases where a single room sensor is to be shared by multiple controllers and the system cannot accommodate the functions; a wall sensor with multiple sensing elements and a ganged setpoint adjustment, under a single sensor, shall be employed. The room sensor shall contain a push-button for override of unoccupied conditions, a cancel button for the override, and a plug-in communications jack for connection of an HHOT.

D. Controller Mounting

1. VAVDC's shall be provided and field mounted by the BAS contractor.
2. The VAV terminal manufacturer shall provide a multi-point, averaging, differential pressure sensor mounted on the inlet to each VAV box. The BAS contractor shall provide and install all wiring between the room sensor and the VAVDC controller.

E. Service Port

1. The VAVDC shall be provided with the ability to interface with a hand held operators terminal (HHOT). The interface port shall be provided at the wall sensor. From the interface port, the HHOT shall be able to directly access any VAVDC under the same parent controller.

F. Air Balance

1. Through the portable hand held operators terminal, the VAVDC shall support a fully prompted Air Balance sequence. The HHOT shall, when connected to the wall sensor, automatically access the connected VAVDC unit. The air balance sequence shall step the balancing contractor through the checkout and calibration of the VAVDC. Upon completion of the balancing sequence, the flow values presented by the VAVDC shall match those observed by the balancing contractor's measurement equipment. Additionally, upon completion of the air balance, the SDC shall automatically archive the balance settings for future use if the controller were to require replacement. Systems not able to provide a formatted air balance HHOT, shall not be acceptable.
2. As a minimum, the balancing program shall step the balancing contractor through the following functions:
 - a. Check damper linking for full end to end stroke travel.
 - b. Calibrate minimum CFM flow value
 - c. Verify and set maximum CFM flow value
 - d. Verify and set reheat flow setpoint
 - e. Calibrate Maximum CFM flow value
 - f. Verify and set minimum CFM flow value
3. The VAVDC shall provide manual position of the actuator with visual indication of the

position of the actuator.

G. Diagnostics

1. The VAVDC shall provide LED indication of transmit/receive communications performance, as well as for the proper/improper operation of the controller itself.

H. Reliability/Accuracy

1. The VAVDC control algorithms shall be designed to limit the frequency of damper repositioning, to assure a minimum 10 year life from all components of the VAVDC. The VAVDC shall provide zone control accuracy of not more than +/- 1 Deg F (Degree Fahrenheit). Systems providing control accuracy's greater than +/- 1 Deg F shall not be acceptable. With the submittal package, contractor shall provide performance data that verifies control accuracy of the VAVDC.
2. The VAVDC shall provide internal differential pressure transducer for pressure independent applications with an accuracy of $\pm 5\%$. Flow through transducers requiring filter maintenance are unacceptable.

I. Zone Sensor

1. The VAVDC shall be fully programmable via a HHOT through the local communications jack at each sensor.
2. The sensor shall have a local thumbwheel setpoint adjustment, a communications jack, a night setback override and a cancel button.
3. The sensor shall have the capability of manually overriding the unit controller from the unoccupied to a timed-override or a continuous occupied mode.

J. Controller Point Capacity

K. Reheat Units

1. The VAVDC controller shall provide input/output points as follows:
 - a. Self-calibrating Velocity Pressure input (0-2"WC). The velocity pressure transducer shall be a continuously self-calibrating unit, which determines the zero velocity pressure point, by equalizing the pressure across the sensing element, every 10-15 seconds.
 - b. Room Temperature Input
 - c. Occupancy Override Input
 - d. VAV Box Damper Output: Unless otherwise specified, the controller shall provide a minimum 30 lb./inch integral electric actuator, having a 90 degree stroke rotation in a time of 3 minutes maximum.
 - e. Occupancy or Status Input
 - f. 0-100% Position Indication of Primary Damper Actuator -Direct feedback from damper actuator
 - g. Room Setpoint Input
 - h. Auxiliary Temperature Input
 - i. HHOT Interface

- j. A minimum of 3 digital outputs for fan control and up to 2 stages of electric reheat. Digital outputs shall be capable of accommodating 24 Vac pilot duty loads. The use of Dynamic Data Exchange.

3.6 HAND HELD OPERATOR TERMINAL (HHOT) SOFTWARE

A. General

1. The HHOT software shall reside on the HHOT system harddrive, and shall operate under a compatible version of MS-Windows operating system software. All commands and data entry templates shall use pop-up, English language menus. Systems that require the HHOT to be preprogrammed with retrievable data are not acceptable. It is the intent of this specification to provide complete flexibility to the operator when viewing network data. Systems that require pre-definition of information to be retrieved by the HHOT must provide an HHOT at each controller to assure that all controller data throughout the network is available.

B. Connectivity

1. The HHOT software shall allow the same HHOT to be connected to any device type on the BAS controller network. Connection shall be via a manufacturer's supplied cable interface for all wall sensor, AHDC and LIDC locations, and an RS-232C cable at all SDC and MSDC service port locations.
2. The HHOT shall allow access to all AHDC's, LIDC's, UDC's and VAVDC's connected to the network. The user shall be able to communicate with the AHDC's, LIDC's, UDC's and VAVDC's with or without an SDC on the communications bus.

C. Functionality

1. The HHOT shall monitor real time point performance through a real time graphical point display. Analog values shall be display as dynamic bar chart values or in dynamic text mode.
2. The HHOT shall perform a real time dynamic graphical line trend, in strip chart format, concurrently on a minimum of 2 process values, in user defined sample intervals ranging from 5 seconds to 256 seconds per sample.
3. The HHOT shall Allow timed or indefinite overrides of any input/output point within the accessed controller. The overridden point shall display on the point status screen as overridden.
4. The HHOT shall provide system diagnostics and status details regarding the controller input/output points, the controller memory and the controller time clock (if present).

D. Database Engineering Tools

1. The HHOT shall allow the copying of settings such as setpoints and configuration from one device to another.
2. The HHOT shall permit uploading and downloading of a program from a device to the HHOT magnetic media storage device.

3. The HHOT shall allow creation and editing of device files off-line.
4. The HHOT shall allow creation and editing of application control files on-line.

E. Hand Held Operator Terminal (HHOT) Hardware

F. General

1. One HHOT shall be provided with a standard hardware configuration. The hardware shall consist of a Laptop Computer Platform with 15.4" Color Display.

G. Computer Platform:

7th Generation Intel Core i5-7300HQ Quad Core or higher.
8.0 GB, DDR4 RAM
1.0 TB hard disk drive.
DVD-ROM/CDRW drive.
15.4" WXGA LCD display
NVIDIA GeForce GTX 150 with 4 GB GDDR5 graphics memory
Integrated 10/100 Ethernet LAN.

H. Operating System:

Microsoft Windows 11 pro
Intuit Quicken Basic 2018.
Norton Antivirus 2018
Adobe Acrobat Reader

END OF SECTION 23 09 00

SECTION 23 80 00 - HEATING, VENTILATION AND AIR CONDITIONING

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 RELATED WORK SPECIFIED ELSEWHERE IN THE SPECIFICATIONS

- A. General Requirements for Mechanical Work - Section 23 05 00.
- B. Test and Balance - Section 23 05 93.
- C. Plumbing - Section 22 00 50.
- D. Direct Digital Controls - Section 23 09 00.
- E. Electrical - Division 26.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's latest published product data for all materials for approval. See Section 23 05 93.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver distribution devices in individual wrappings to prevent damage to finish surface of device. Store in a dry, protected area until installed. After installation of devices, clean soiled finishes.

PART 2 - PRODUCTS

2.1 AIR COOLED WATER CHILLERS

- A. General: Units are constructed of galvanized steel frame with galvanized steel panels and access doors. Component surfaces are finished with a powder-coated paint. Each unit ships with full operating charges of refrigerant and oil.
- B. Acceptable manufacturers are Trane, Carrier, Daikin and Johnson Controls.
- C. Warranty: The chiller manufacturer's refrigerant/parts/labor warranty shall be for a period of

one year from the date of equipment start-up. The compressors shall also include a 5-year parts warranty. Routine maintenance of the chiller shall be the responsibility of the owner.

- D. **Compressor and Motor:** The unit is equipped with two or more hermetic, direct-drive, 3600 rpm 60 Hz (3000 rpm 50 Hz) suction gas-cooled scroll compressors. The simple design has only three major moving parts and a completely enclosed compression chamber which leads to increased efficiency. Overload protection is included. The compressor includes: centrifugal oil pump, oil level sight glass and oil charging valve. Each compressor will have compressor heaters installed and properly sized to minimize the amount of liquid refrigerant present in the oil sump during off cycles.
- E. **Unit-Mounted Starter:** The control panel is designed per UL 1995. The starter is an across-the-line configuration, factory-mounted and fully pre-wired to the compressor motor and control panel. A factory-installed, factory-wired 820 VA control power transformer provides all unit control power (120 Vac secondary) and Trane CH530 module power (24 Vac secondary). Power line connection type is standard with a terminal block.
- F. **Evaporator:** Braze plate heat exchanger is made of stainless steel with copper as the braze material. It is designed to withstand a refrigerant side working pressure of 430 psig (29.6 bars) and a waterside working pressure of 150 psig (10.5 bars). Evaporator is tested at 1.1 times maximum allowable refrigerant side working pressure and 1.5 times maximum allowable water side working pressure. It has one water pass. Immersion heaters protect the evaporator to an ambient of -20°F (-29°C). The evaporator is covered with factory-installed 0.75 inch (19.05 mm) Armaflex II or equal (k=0.28) insulation. Foam insulation is used on the suction line. Water pipe extensions with insulation go from the evaporator to the edge of the unit.
- G. **Condenser:** Air-cooled condenser coils have aluminum fins mechanically bonded to internally-finned copper tubing. The condenser coil has an integral subcooling circuit. The maximum allowable working pressure of the condenser is 650 psig (44.8 bars). Condensers are factory proof and leak tested at 715 psig (49.3 bars). Direct-drive vertical discharge condenser fans are balanced. Three-phase condenser fan motors with permanently lubricated ball bearings and external thermal overload protection are provided. Units start and operate from 0°F to 125°F (-18°C to 52°C) for wide ambient. Wide ambient allows operation down to 0°F which is accomplished by a variable speed fan on each circuit that modulates to maintain system differential pressure.
- H. **Refrigerant Circuit and Capacity Modulation:** The 20-35 ton units have single refrigerant circuits. The 40-130 ton units have dual refrigerant circuits. Each refrigerant circuit has Trane scroll compressors piped in parallel with a passive oil management system. A passive oil management system maintains proper oil levels within compressors and has no moving parts. Each refrigerant circuit includes filter drier, electronic expansion valve, and liquid line and discharge service valves. Capacity modulation is achieved by turning compressors on and off. The 20-35 ton units have two capacity stages. The 40-120 ton units have four capacity stages. The 130 ton unit has six capacity stages.
- I. **Unit Controls:** The microprocessor-based control panel is factory-installed and factory-tested. The control system is powered by a pre-wired control power transformer, and will turn on and off compressors to meet the load. Microprocessor-based chilled water reset based on return

water is standard. The Trane CH530 microprocessor automatically acts to prevent unit shutdown due to abnormal operating conditions associated with low evaporator refrigerant temperature and high condensing temperature. If an abnormal operating condition continues and the protective limit is reached, the machine will shut down.

- J. The panel includes machine protection for the following conditions:
 - 1. Low evaporator refrigerant temperature and pressure
 - 2. High condenser refrigerant pressure
 - 3. Critical sensor or detection circuit faults
 - 4. High compressor discharge temperature (with low temp evaporator)
 - 5. Lost communication between modules
 - 6. Electrical distribution faults: phase loss, phase reversal or over temperature protection
 - 7. External and local emergency stop
 - 8. Loss of evaporator water flow

- K. When a fault is detected, the control system conducts more than 100 diagnostic checks and displays results. The display will identify the fault, indicate date, time, and operating mode at time of occurrence, and provide type of reset required and a help message.

- L. Factory-mounted to the control panel door, the operator interface has an LCD touch-screen display for operator input and information output. This interface provides access to the following information: evaporator report, condenser report, compressor report, ASHRAE Guideline 3 report, operator settings, service settings, service tests, and diagnostics. All diagnostics and messages are displayed in "clear language."

- M. Data contained in available reports includes:
 - 1. Water and air temperatures
 - 2. Refrigerant pressures and temperatures
 - 3. Flow switch status
 - 4. EXV position
 - 5. Compressor starts and run-time

- N. All necessary settings and setpoints are programmed into the microprocessor-based controller via the operator interface. The controller is capable of receiving signals simultaneously from a variety of control sources, in any combination, and priority order of control sources can be programmed. The control source with priority determines active setpoints via the signal it sends to the control panel.

- O. Control sources may be:
 - 1. Local operator interface
 - 2. BACNet interface

- P. The quality management system applied by Trane has been subject to independent third-party assessment and approval to ISO 9001-2008. The products described in this catalog are designed, manufactured and tested in accordance with the approved system requirements

described in the Trane Quality Manual.

Q. Required Options:

1. Circuit Breaker: Amolded case standard interrupting capacity circuit breaker, factory pre-wired with terminal block power connections and equipped with a lockable external operator handle, is available to disconnect the chiller from main power.
2. BACNet Interface: Allows user to easily interface with BACNet via a single twisted-pair wiring to a factory-installed and tested communication board.
3. Comprehensive Acoustic Package: This option includes acoustical treatment for compressor.
4. Condenser Coil – CompleteCoat: Condenser coils are made of aluminum fins (plate fins) mechanically bonded to internally finned copper tubes. The condenser box is then submerged in an epoxy polymer bath where an electrostatic charge is used to uniformly deposit the epoxy onto the coil. This option resists bi-metallic corrosion and allows for operation in coastal environments.
5. Insulation for High Humidity: The evaporator is covered with factory-installed 1.25 inch (31.8 mm) Armaflex II or equal ($k=0.28$) insulation. Foam insulation is used on the suction line.

2.2 CENTRAL STATION AIR HANDLING UNITS

A. Modular air handling units shall be manufactured by Trane, Johnson Controls or Carrier.

1. Fabricate unit with 16-gauge nominal channel posts and panels secured with mechanical fasteners. All panels, access doors, and ship sections shall be sealed with bulb-type gasket.
2. Panels and access doors shall be constructed as a 2-inch (50-mm) nominal thick, thermal broke double wall assembly, injected with foam insulation for an R-value of not less than R-13. The outer panel shall be constructed of G90 galvanized 18-gauge steel. The inner liner shall be constructed of G90 galvanized steel. Panel deflection shall not exceed $L/240$ ratio at 125% of design static pressure, minimum 5 inches of positive or negative static pressure. Deflection shall be measured at the midpoint of the panel height.
3. Access doors shall be flush mounted to the cabinetry and secured with heavy-duty stainless steel hinges. The door latch handle assembly shall be provided with a full-size grip handle and roller pall for smooth operation. The assembly shall be gasketed and sealed to prevent thermal bridging.
4. The casing leakage rate shall not exceed ASHRAE 111 Class 6 @ 8" of static pressure (positive or negative).
5. Module to module assembly shall be accomplished with an overlapping, full perimeter, insulated, internal splice joint sealed with bulb type gasketing on both mating modules to minimize on-site labor and meet indoor air quality standards.

B. Cooling Coil Section:

1. Coils are accessible from both sides of unit for service and cleaning. The coil headers and return bends are fully enclosed within unit casing. The air handling unit is furnished

with coil connections that extend a minimum of 5" (127 mm) beyond unit casing for easy installation. Drain and vent connections are located on the coil connections. The coil connections are factory sealed with grommets where the piping extends through the unit casing to avoid air leakage and comply with indoor air quality standards. Coils are removable through side panels of unit without removal and disassembly of entire unit.

2. Coils are ARI certified and Underwriters Laboratories, Inc. listed. Capacities, pressure drops, and selection procedures are in accordance with ARI 410.
3. Drain pans are constructed from stainless steel, cross broken and pitched (double sloped) to the drain connection. The drain pan extends the full depth of the cooling coil section to completely drain any condensate. Intermediate drain pans are provided for cooling coil banks two coils high. Drain pan coating is microbial resistant. The drain connection center line is a minimum of 3" (76 mm) above finished floor for trapping. The variable base rail height will provide additional height for trapping.

*Optional moisture eliminators are constructed of three break galvanized steel and mounted over drain pan and on the leaving air side of the coil casing.

C. Water Coils:

1. Fins have a minimum thickness of .0095" (.24 mm) of aluminum plate construction. Fins have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes are constructed of 5/8" OD seamless copper mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes are not visible between fins.
2. Water coils provided with round seamless 5/8" OD copper .024" (.61 mm) nominal tube wall thickness, expanded into fins. All joints brazed.
3. Water coils are provided with headers of seamless copper tubing with intruded tube holes that permit expansion and contraction without creating undue stress or strain. The casing is formed channel frame of stainless steel. Coil connections are carbon steel with size provided by manufacturer based upon the most efficient coil circuiting. Coil vents and drains are provided on the coil connection outside the unit casing. Vent connections provided at the highest point to assure proper venting. Drain connections provided at the lowest point to insure drainage and prevent freeze-up.

D. Supply Fans

1. Double width, double inlet, housed forward curved fans are dynamically balanced as an assembly. The maximum fan RPM is always below the first critical fan speed. Forward curved fans with inlet vanes will have a heavy-duty linkage connecting both vane assemblies. The inlet vane actuating mechanism is permanently lubricated and interconnected by a solid steel shaft through oil impregnated bronze bushings mounted in the fan housing.
2. Double width, double inlet, housed airfoil fans are dynamically balanced as an assembly. Maximum fan RPM is always below the first critical fan speed. Airfoil fans with variable inlet vanes are controlled with a center hub linkage. Vanes are fabricated from steel with a baked enamel finish capable of withstanding entering air temperature up to 200°

F (93° C). The inlet vane actuating mechanism is permanently lubricated and interconnected by a solid steel shaft through oil impregnated bronze bushings mounted in the fan housing.

3. Drive - The fan and motor are internally mounted on a steel base. The motor base can be slid out the side of unit if removal is required. Access is provided to motor, drive, and bearings through a hinged access door.
4. Mounting - Fan and motor assemblies can be provided with 2" internally mounted spring isolators, rubber in shear mounts, or rigid mounts.
5. Bearings - Fan bearings are sealed, self-aligning, grease lubricated, ball bearings. The extended copper lubrication lines are furnished on the access side of unit. The grease fittings are attached to fan base assembly, near the access door.
6. The bearing load rating is computed in accordance with AFBMA - ANSI Standards, L-50 life at 500,000 hours-all DWDI fans. It is a heavy-duty pillow block type, self-aligning, grease-lubricated ball bearing.
7. The V-belt drive has cast iron or steel sheaves, dynamically balanced, and bored to fit shafts and keyed. Variable and adjustable pitch sheaves are selected so that the required rpm is obtained with sheaves set at mid-position. The standard drive service factor is 1.1 (7 1/2 HP & smaller) or 1.3 (10 HP & larger) times fan brake horsepower, or optional customer specified service factor.
8. The shaft is solid, hot rolled steel, ground and polished, keyed to the shaft, and protectively coated with lubricating oil.
9. Motors - Electrical Characteristics: 208 volts, three phase, 60 Hz.
10. Motor type ODP premium efficiency type.

E. Filters

1. The filter section includes filter racks, and hinged and latching access doors on either, or both sides of the section for side or front loading and removal of filters. Filter racks are suitable for a 2 inch (50 mm) deep prefilter and cartridge final filters. The filter media and blank-off sheets are also provided. The 2" deep pre-filters shall have a 30-35 percent (MERV-8) dust spot efficiency. The extended surface cartridge media filters are available with 80-90 percent (MERV-13) dust spot efficiency. Primary filter media is 4" deep.

2.3 VARIABLE AIR VOLUME AIR TERMINAL UNITS

- A. The Contractor shall furnish and install variable air volume units as herein specified and as scheduled on drawings. The units shall be installed in accordance with this specification and the variable volume unit manufacturer's printed recommendations. Variable air volume unit capacities shall be per schedules. Units shall be UL listed and ARI 880 Certified.
- B. Units shall be completely factory assembled, manufactured of corrosion protected steel and fabricated to withstand the pressures encountered. Minimum construction gauges shall be 22-gauge for casings, 16-gauge for damper and 22-gauge for damper seat.
- C. Box construction shall include an access door in the bottom of the enclosure for access to the hot water coil.

- D. All interior surfaces shall be acoustically and thermally insulated with 1" thick, 2.0 lb. (R = 4.3) density insulation. Insulation shall be glass fiber with foil face. The insulation shall be UL listed and approved for UL Standard 181. The insulation shall meet NFPA 90A requirements. Provide metal fasteners to attach insulation to casing.
- E. Air volume control shall be accomplished at the unit inlet by an air valve or heavy duty damper. The unit shall modulate from design air flow to scheduled minimum air flow as indicated. The device shall be capable of a tight shut-off. The average leakage rate across the air throttling device shall not exceed one-percent (1%) differential at 6" water gauge.
- F. An integral flow ring sensor or other averaging type calibration device shall be provided along with unit mounted calibration chart to insure accuracy of airflow measurement to +/-5% under all types of inlet conditions.
- G. NC level during fan operation based on ARI Standard 880 shall not exceed 28 NC based on 8 db room effect and 10 db ceiling transmission loss. VAV manufacturer must provide attenuators for boxes as required to meet sound requirements.
- H. Heating/Cooling Units: Reheat boxes shall modulate down to a factory set minimum cfm before bringing on heating. Air pressure drop at full load shall not exceed .5".
- I. VAV Unit Control: VAV box damper motor and controller shall be provided by temperature control contractor and field mounted by controls or mechanical contractor. Controls shall be mounted in an enclosure with a side hinged access door. Control power will be 24V. Provide factory mounted 208V/24V controls transformer. See Temperature Control Section. Controls shall be pressure independent.
- J. VAV Heating: Electric reheat coils shall be factory installed and shall be furnished with single stage controllers and safety devices as required by NEC. Units shall bear UL approval. Contactors shall be magnetic type. Provide with integral disconnect.
- J. Acceptable manufacturers are E H Price, Carrier, Johnson Controls, Enviro-Tec, Titus or Trane.

2.4 BASE MOUNTED, FLEXIBLE COUPLED, END-SUCTION PUMPS

- A. Furnish and install pumps with performance characteristics as shown on plans. Pumps shall be base mounted, single stage, end suction design with a foot mounted volute to allow removal and service of the entire rotating assembly without disturbing the pump piping, electrical motor connections or pump to motor alignment.
- B. Pump volute shall be Class 30 cast iron with integrally-cast pedestal support feet. The impeller shall be cast bronze enclosed type, balanced to ANSI/HI 1.1-1.5-1994, section 1.4.6.1.3.1, figure 1.106, balance grade G6.3 and keyed to the shaft and secured by a locking capscrew.
- C. The liquid cavity shall be sealed off at the pump shaft by an internally-flushed mechanical seal with ceramic seal seat and carbon seal ring, suitable for continuous operation at 225°F

(107°C). A replaceable bronze shaft sleeve shall completely cover the wetted area under the seal.

- D. Pump shall be rated for minimum of 175 psi (12 bar) working pressure. Volute shall have gauge tappings at the suction and discharge nozzles and vent and drain tappings at the top and bottom.
- E. The pump(s) vibration limits shall conform to Hydraulic Institute ANSI/HI 1.1-1.5-1994, section 1.4.6.1.1 for recommend acceptable unfiltered field vibration limits (as measured per HI 1.4.6.5.2, Figures 1.108) for pumps with rolling contact bearings.
- F. Baseplate shall be of structural steel or fabricated steel channel with fully enclosed sides and ends, and securely welded cross members. Grouting area shall be fully open. The combined pump and motor baseplate shall be sufficiently stiff as to limit the susceptibility of vibration. The minimum baseplate stiffness shall conform to ANSI/HI 1.3.4-1997 for Horizontal Baseplate Design standards.
- G. The seismic capability of the pump shall allow it to withstand a horizontal load of 0.5g, excluding piping and/or fasteners used to anchor the pump to mounting pads or to the floor, without adversely affecting pump operation.
- H. A flexible type, center drop-out design coupler, capable of absorbing torsional vibration, shall be employed between the pump and motor. Pumps for variable speed application shall be provided with a suitable coupler sleeve. The coupling shall be shielded by a dual rated ANSI B15.1, Section 8 & OSHA 1910.219 compliant coupling guard and contain viewing windows for inspection of the coupling.
- I. Motor shall meet NEMA and Premium efficiency specifications and shall be of the size, voltage and enclosure called for on the plans. Pump and motor shall be factory aligned, and shall be realigned by the contractor per factory recommendations after installation. Motor shall be inverter duty.
- J. The pump(s) selected shall conform to ANSI/HI 9.6.3.1 standards for Preferred Operating Region (POR) unless otherwise approved by the engineer. The pump NPSH shall conform to the ANSI/HI 9.6.1-1997 standards for *Centrifugal and Vertical Pumps for NPSH Margin*.
- K. Each pump shall be factory hydrostatically tested per Hydraulic Institute standards. It shall then be thoroughly cleaned and painted with at least one coat of high grade paint prior to shipment.
- L. The pump(s) shall be manufactured, assembled and tested in an ISO 9001 approved facility.
- M. Pumps shall be Series 1510 as manufactured by ITT Bell & Gossett or equal. Equivalent manufacturers shall be Taco, Patterson, Armstrong, and Aurora

2.5 SUCTION DIFFUSERS

- A. Furnish and install as shown on plans, an angle pattern flow straightening fitting equipped with a combination diffuser/strainer- orifice cylinder, flow straightening vanes, start-up strainer and adjustable support foot (supplied by others). The combination diffuser-strainer-orifice cylinder shall be designed to withstand pressure differential equal to the system pump shutoff head (maximum 175 PSIG) and shall have a free area equal to five times the cross section area of the pump suction opening. The length of the flow straightening vanes shall be no less than 2 1/2 times the diameter of the system pump suction connection.
- B. The flow straightening fitting shall be of cast iron construction with flanged system and flanged pump connections. The fitting shall have a carbon steel combination diffuser-strainer-orifice cylinder with 3/16" diameter perforations to protect the system pump. The full length carbon steel flow straightening vanes shall provide non-turbulent flow to the suction side of the system pump. The start-up strainer shall be of 16 mesh bronze, and the support foot (supplied by others) shall eliminate pipe strain at the flow fitting/pump connection. All internal components shall be replaceable.

2.6 GRILLES, REGISTERS, AND DIFFUSERS

- A. Location of ceiling mounted air distribution shall be as shown on reflected ceiling plan. Install and fasten air distribution per manufacturer's detailed drawings. Use gaskets to make air tight joints with adjoining construction. Join neatly with adjacent finished surface.
- B. General ceiling diffusers shall be equal to Titus Model TDC-AA with round neck. Diffusers in lay-in ceilings shall be 24" x 24" with an opposed blade damper and directional throws as indicated. Diffusers in hard ceilings shall be 12"x12" with an opposed blade damper and direction throws as indicated. Finish shall be off-white color with square to round duct connection. Round duct connection and face size shall be as shown on plans.
- A. General exhaust, return air and transfer registers shall be 1/2" x 1/2" eggcrate type equal to Titus 50F with opposed blade dampers. Furnish in an off-white enamel finish. All perforated grilles in lay-in ceilings shall be 24" x 24". See plans for neck sizes.
- E. Sidewall supply registers shall be equal to Titus 272FL with 3/4" blade spacing and opposed blade dampers.
- F. Sidewall return and exhaust registers shall be equal to Titus 55FL with 3/4" blade spacing, 0° fixed deflection, and opposed blade dampers.
- H. Acceptable manufacturers are E H Price, Anemostat, Carnes, Metal-Aire, Nailor-Hart, Titus, and Tuttle and Bailey.

2.7 INLINE CENTRIFUGAL DUCT MOUNTED FANS

- A. Duct mounted fans shall be of centrifugal, direct driven in-line type.
- B. The fan housing shall be of the square design, constructed of heavy gauge galvanized steel and shall include square duct mounting collars.
- C. Fan construction shall include two removable access panels located perpendicular to the motor mounting panel. The access panels must be sufficient size to permit easy access to all interior components.
- D. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced.
- E. Motors shall be permanently lubricated and carefully matched to the fan loads. Motors shall be readily accessible for maintenance.
- F. A NEMA 1 disconnect switch shall be provided as standard, except with explosion resistant motors, where disconnects are optional. Factory wiring shall be provided from motor to the handy box.
- G. All fans shall bear the AMCA Certified Ratings Seal for both sound and air performance.
- H. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.
- I. Fans shall be Model SQ as manufactured by Greenheck. Acceptable alternate manufacturers are Cook and Penn and Twin City Fans.

2.8 WALL MOUNTED ELECTRIC UNIT HEATER

- A. Heater shall have spiral finned metal sheathed elements. Spiral fins shall be brazed to sheath to insure proper heat transfer.
- B. Safety protection shall be provided by an automatic reset wired in heater circuit to de-energize element and motor circuit in case of an over temperature condition.
- C. Motor shall be totally enclosed and permanently lubricated. Motor circuit shall have fan delay to insure heated air delivery when heater comes on and to dissipate heat when heater is off.
- D. Heater shall have built-in thermostat and disconnect switch with either tamper proof control knobs or exposed control knobs as listed on the schedule.
- E. Wall heater shall be UL listed and shall be installed in accordance with the manufacturer's instructions.

F. Basis of Design is Markel Series 3320.

2.9 MINI-SPLIT SYSTEM AIR CONDITIONING UNITS (Ductless Type Unit)

- A. Indoor fan coil units shall be wall mounted type, ceiling mounted, or in-line as specified on the drawings. The cabinet for wall mounted and ceiling mounted models shall be attractive with painted baked enamel. Provide unit with heavy gauge aluminum return air grille, washable aluminum filter, four-way adjustable discharge louver, wall mounted (wired) thermostat and 2-speed fan switch, 2-speed fan motor, sweat type refrigerant connections and integral condensate drain pan.
- B. Outdoor condensing unit shall be compact with low profile design. Cabinet shall be galvanized steel with baked enamel finish. Safety controls shall include low and high pressure switches. Unit may be equipped with a rotary or reciprocating type compressor. Provide sweat type refrigerant connections.
- C. Equipment installation and refrigerant sizing shall be per manufacturer's instructions. Refrigerant type shall be R-410A. Unit shall be manufactured by Daikin or Mitsubishi.

2.10 DUCT MOUNTED ELECTRIC HEATERS

A. General

1. Provide fin tubular, electric duct heaters, as manufactured and as listed in the schedule.
2. Power voltage and phase, control voltage, wattage, duct size, number of steps to be as per schedule.
3. Heaters to be flanged type as called for.
4. Three phase heaters shall have balanced three phase steps unless specified otherwise.
5. All heaters to be UL listed for zero clearance to combustible surfaces and bear the UL label.
6. All heaters shall meet the requirements of the latest National Electric Code.
7. Standard terminal box, recessed terminal box, standard control cabinet, remote control cabinet as well as element housing and racks all to be made of heavy gauge galvanized steel. Provide with door interlock disconnect switch.
8. All heating coils to be made of high grade nickel/chromium precisely centered in stainless steel tube which is filled with granular magnesium oxide. A stainless steel fin is helically wound onto the tube to increase heat transfer.

B. Element Assembly

1. To be of "Module" design with each module independently and easily removable from the terminal box or control cabinet.
 2. Each module to contain no more than 2 layers of element coils so that any one coil may be replaced without disturbing others.
 3. Element coils of each module to be on staggered spacing so that all coils per module will be in the air stream, and shadowing (overheating) and/or blank areas eliminated.
- C. Element Housing - To be of No. 18 Ga. galvanized (aluminized) steel and to be of roll-formed construction with multiple brakes and ribs for stiffness and rigidity.
- D. Element Rack
1. To be constructed of No. 20 Ga. galvanized (aluminized) steel and formed with multiple brakes and ribs for stiffness and rigidity.
 2. Ceramic coil supports to be floating, but contained and easily replaceable.
 3. Ceramic coil insulators to be on staggered spacing per rack to eliminate blank areas in the air pattern thru the heaters, and provide uniform heating over the entire cross section of the element.
 4. Racks to support element coils on no more than 3-1/2" centers.
- E. Terminal Box or Control Cabinet
1. Shall be constructed of heavy gauge galvanized steel (aluminized optional) and in sizes up to 18" x 18" shall be No. 20 gauge and over to be Mo. 18 gauge. All boxes to have a solid cover, of the same gauge, complete with a piano type hinge on the longest side, approved tool operated latch and pull ring. Covers over 48" long to be provided with two latches and pull rings.
 2. Insulation consisting of 1/2" high density fiberglass will be provided, attached to the cabinet, between the cabinet and the heating section.
 3. Recessed terminal boxes used when ducts are internally insulated, or in air handling units, to be of the same general construction as item 1 above.
- F. Airflow Direction - Heaters will be interchangeable for mounting in a horizontal or vertical duct except when position sensitive mercury contactors, SCR's or capillary type limit controls are built-in. In these cases, airflow direction is as specified.
- G. Safety Controls
1. Primary over temperature protection shall be provided by built in disc type automatic reset thermal cutouts for duct heaters up to 10' in width. Heaters over 40" high require

two cutouts. Capillary type automatic reset thermal cutouts are required for any heater 10' wide or over. Capillary type controls to be UL listed and of the "fail safe" type.

2. Secondary over temperature protection shall consist of a sufficient number of load carrying replaceable disc controls to de-energize the elements if the primary system fails.
3. Fuse link type heat limiters shall not be acceptable. All manual safety devices shall be resettable thru the terminal box without removing the heater from the duct.

H. Wiring Diagrams

1. A separate, complete and specific wiring diagram shall be permanently attached to each heater. Typical wiring diagrams are not acceptable.
2. Control and line terminals in each heater shall be marked identical to the wiring diagram.

I. Heater Controls

1. All SCR heater controls shall be factory mounted and wired.
2. Contactors shall be definite purpose type. No application type relays will be acceptable.
3. All controls shall be furnished as specified.

2.11 SHEETMETAL DUCTWORK

A. Ductwork - Low Pressure

1. Route all exposed ductwork tight to the roof structure and sloped to follow the roof. Ductwork shall also be run parallel to the exposed structure.
2. This part of the specification shall apply to all low pressure rectangular shop fabricated ductwork located down stream of all VAV boxes and for all constant air volume air distribution systems and return air systems. Ductwork shall be constructed of galvanized steel sheets, furnished and installed in sizes as indicated and located where shown on the drawings. This part of the work shall include all ductwork, manual dampers, access panels, louvers, etc., with all accessories to make a complete air distribution system. Noise, vibration or drumming of air in ductwork, noises at air outlets or returns, excessive air leaks, malfunctioning of dampers, etc., will be cause for rejecting affected parts of the ductwork. Duct sizes shown on plans are net and must be increased for total insulation thicknesses as herein specified.
3. The Mechanical Contractor shall coordinate with the General Contractor all ductwork penetrations of walls which require lintels per the architectural plans.
4. Weights of materials, types of joints and bracing shall strictly follow the guidelines set forth by SMACNA. All low pressure supply duct (downstream of VAV boxes) shall

comply with SMACNA Standards for 1" of static pressure. All return, exhaust, and transfer duct shall comply with SMACNA Standards for 2" of static pressure.

4. The following details of duct construction shall be adhered to without deviation:
 - a. Longitudinal seams for metal shall be Pittsburgh lock.
 - b. Sweep elbows shall be made with inside radius equal to width of ducts, except as shown on the drawings. Square elbows must be provided with approved turning vanes to assure good air flow to outlets.
 - c. Provide vanes at all elbows. Provide splitter dampers and turning vanes at duct tees.
 - d. Horizontal ducts shall be hung at intervals not exceeding 8'-0" with 18-gauge galvanized iron hangers extending the full height of the duct.
 - e. Shop drawings of all ductwork when for any reason different from drawings shall be submitted to the Architect for approval.
 - f. All ductwork shall be fabricated in strict accordance with SMACNA Construction Standards for Low Velocity Ductwork. All seams shall be caulked or taped to prevent air leakage.
5. Flexible Ductwork Connections: All duct connections to air handling units, fans, etc., shall be made through a 4" flexible connection of fire resistant neoprene coated glass fiber cloth as manufactured by Wiremold, Thermoflex, or Fentfab. Connection shall meet pressure classification of system used.
6. Spin-in taps for connection runouts to trunk duct shall be Air-Trac, Dace, Flexmaster and R & J Manufacturing or approved equal with balancing butterfly damper stand-off bracket and scoop. Provide minimum 22-gauge spin-in and scoop and 20-gauge damper. Perimeter clearance of damper in spin-in shall not exceed 1/8".
7. Take-offs where branch duct diameter exceeds the height of the trunk duct shall be Flexmaster STO-B03 or equal with continuous damper shaft and stand-off bracket.

B. Ductwork - Medium Pressure

1. Route all exposed ductwork tight to the structure and sloped to follow the roof. Ductwork shall also be routed parallel to the roof structure.
2. This part of the specification shall apply to all medium pressure ductwork used in heating, air conditioning and ventilating systems for air delivery to the variable air volume units. Ductwork shall be constructed of galvanized steel, furnished and installed in sizes as indicated and located where shown on the drawings. This part of the work shall include all ductwork, fittings, transitions, etc., with all accessories to make a complete system. Noise, vibration or drumming of air in ductwork, air leaks, etc., will be cause for rejecting affected parts of the ductwork. Duct sizes shown on the plans are internal and must be increased for total insulation thicknesses as herein specified.
3. Manufacturers of spiral ductwork and associated products shall be by Lindab, Impulse Air, Monroe Metal, United McGill Corp., Spiral Pipe of Texas, or Semco.
4. Turning vanes in medium pressure ductwork shall be double wall type.
5. All round and flat oval ductwork shall be manufactured by the same firm to assure tight fit of all ductwork and components. The Contractor shall submit with his bid the name of the manufacturer of the spiral ductwork and fittings.
6. The duct manufacturer shall provide data covering leakage rate, bursting strength, collapsing strength, seam strength, and friction loss. Friction loss test data shall cover both the duct and the assembled coupling joints.

7. Fitting test data shall be provided which shall cover the friction loss tests of die-stamped elbows in diameters 3" through 8", 5 - piece gored elbows in diameters 9" through 30", reducers, and divided flow fittings of tee, lateral, and conical types, plus the coefficients of abrupt turn fittings, including Y-branch, cross, and mitered elbow fittings.
8. Installation manuals shall be submitted to the Contractor. These manuals shall provide detailed instructions on:
 - a. Assembly
 - b. Joint Sealing
 - c. Erection
 - d. Reinforcement of Flat-Oval Duct
 - e. System Pressure Testing for Leaks
9. Round duct shall be manufactured of galvanized steel meeting ASTM A-527-67 by the following methods and in the minimum gauges listed:

<u>Diameter</u>	<u>Minimum Gauge</u>	<u>Method of Manufacture</u>
3" thru 8"	24	Spiral Lockseam
9" thru 22"	24	Spiral Lockseam
23" and greater	22	Spiral Lockseam

10. The spiral duct shall have locked seams so made as to eliminate any leakage under pressure for which this system has been designed.
11. Longitudinal seam duct shall have a fusion-welded butt seam.
12. Fittings and couplings shall be 20-gauge.
13. All fittings shall have continuous welds along all seams. All divided flow fittings are to be manufactured as separate fittings, not as tap collars welded into spiral duct section.
14. All 90° tees and 45° laterals (wyes) up to and including 12" diameter tap size shall have a radiused entrance into the tap, produced by machine or press forming. The entrance shall be free of weld build-up, burrs, or irregularities.
15. Elbows in diameters 3" through 8" shall be two section stamped elbows. All other elbows shall be gored construction with all seams continuous-welded. Elbows shall be fabricated to a centerline radius of 1.5 times the cross-section diameter.
16. Bell Mouth connections shall be used at each round take-off.
17. Galvanized areas that have been damaged by welding shall be coated with corrosion resistant aluminum paint.
18. Couplings for Round Medium Pressure Duct: Pipe-to-pipe, joints in diameters to 30" shall be the use of sleeve couplings, reinforced by rolled beads.
19. Pipe-to-fitting joints in diameters to 30" shall be by slip-fit of projecting collar of the fitting into the pipe.
20. Insertion length of sleeve coupling and fitting collar shall be 2".
21. The flat oval duct and fittings shall be supplied by a company who has had as its principal business the manufacturer of medium pressure duct and fittings for at least 10 years.
22. Flat oval duct shall be supplied as spiral flat oval duct in the following U.S. Standard gauge galvanized steel:

Maximum Width Gauge
 22 to 24"
 25" and greater

23. All flat oval duct shall be adequately braced by the installing contractor to limit the amplitude of all vibration to plus/minus 0.088 and the maximum wall deflection to 0.52" at 6" S.P.
24. Matching flat oval fittings shall be manufactured from 20-gauge galvanized steel with continuous welded seams.
25. Sealer for Medium Pressure Ductwork: Sealer shall be applied to the male end of the couplings and fittings. After the joint is slipped together, sheetmetal screws shall be placed 1/2" from the joint bead for mechanical strength. Sealer shall be applied to the outside of the joint extending 1" on each side of the joint bead and covering the screw heads. Sealer shall be by United "Hardcast" or approved equal.
26. The duct sealer shall be specifically formulated for the job of sealing the field joints for spiral round and flat oval duct systems. The sealer shall be compatible with plastic backed duct tape so the two shall cure and bond together. Samples of sealer and tape and the specifications data sheets shall be submitted to the Engineer for approval.
27. Flanged joints shall be sealed by neoprene rubber gaskets. Sealer shall be acceptable by the spiral and flat oval duct manufacturer.
28. Companion flange shall be provided on all oval and spiral ductwork with a major axis of 42" and greater. The companion flanges shall be factory provided and installed. Ductwork with a major axis less than 42" do not require companion flanges.
29. Leak Testing Medium Pressure Ductwork: The installed duct system shall be tested to the designed operating pressure. Conduct tests in presence of Facilities Division Engineer. Notify same 24 hours in advance.
30. The air leakage at the test pressure shall be measured by a calibrated orifice type of flow meter. Test procedures shall be in accordance with SMACNA HVAC Air Duct Leakage Test Manual. The duct shall be tested at 3" w.c. and shall provide a Class A leakage rating.
31. If the system is tested in sections, the leakage rates shall be added to give the performance of the whole system.
32. Leakage concentrated at one point may result in objectionable noise even if the system passes the leakage rate criteria. The noise source must be corrected to the satisfaction of the Engineer.
33. Push rods shall be provided with dampers at all branch connections to main headers in accordance with SMACNA Standards.
34. Flexible ductwork shall be equal to Metalflex V-200 UL Class 1 corrugated flexible aluminum medium pressure systems. Provide sealant and sheet metal screws for connections to outlets and ductwork. Methods of connection shall be in accordance with SMACNA Construction Standards and plan requirements. Maximum length of flex duct shall be 8'-0". Provide round rigid galvanized duct up to within 8 feet of air device locations where required.
35. LoLoss Tees for runouts to VAV boxes shall be provided with a balancing damper and stand-off bracket.

C. Miscellaneous Ductwork Requirements:

1. At the A/C unit discharge, the first 20 feet of ductwork shall be thermally acoustically lined type similar to Acoust-K27 with 1" insulation and a perforated liner as manufactured by United McGill Corporation. All exposed spiral duct shall also meet this

requirement. Joints shall be made with slip-joint type couplings similar to flat oval ductwork. See the Insulation paragraph of this specification for locations requiring internally lined duct.

2. All exposed spiral duct shall be double wall with a pintable exterior surface.

2.12 FLEXIBLE DUCT

- A. Core: Metal Helix mechanically bonded to an acoustically transparent flexible fabric with rip stop reinforcement; U.L. listed Class 1 air duct connector; compliance with NFPA 90A and 90B; pressure rated to 10" W.G. and 200° F. Helix not constructed of corrosion resistant metal shall be coated to prevent corrosion. Unreinforced polyester material is not acceptable for core.
- B. Insulation: All flexible duct shall be insulated unless otherwise noted. Insulation shall be 1" minimum thick, 3/4 lb. minimum density fiberglass with vapor barrier jacket. Aluminum foil jackets shall be reinforced.
- C. Installation: SMACNA HVAC Duct Construction Standards, Third Edition, 2005. Flexible duct shall be installed in a fully extended condition free of sags and kinks, in maximum lengths of 8 feet (in minimum lengths to make smooth connection). Flexible duct shall NOT be utilized to correct for misalignment or round to oval transitions. All flexible duct connections shall be made by coating the interior of the duct to a depth of 3" with an approved high pressure duct sealer, and secured in place over sheet metal collar with 1/2" wide positive locking steel straps. Vertically suspended ducts shall be additionally secured with a minimum of three sheet metal screws on no greater than 8" centers. Horizontal support shall be provided at maximum intervals of 3 feet with 3" wide flat banded material or as recommended by manufacturer. Wire hangers shall not be used under duct. Flexible duct shall be utilized only where shown or specifically called for in specifications.
- D. Manufacturers: Flexmaster Type 1M acoustically insulated, Thermaflex MKE or approved equivalent by prior approval.

2.13 ACCESS DOORS

- A. Air duct access doors shall be steel of the double wall insulated type complete with hinges and camlock latches. Insulation shall be 1" thick fiberglass with "K" factor of .26 at 75°F mean temperature. Provide access doors at all fire dampers and where indicated. Doors smaller than 8" shall have plexiglass window. Coordinate with specification section 08345 (this contractor to furnish).

<u>Duct Diameter</u>	<u>Access Opening</u>
8" thru 10"	7" dia.
11" thru 13"	10" dia.
14" thru 19"	13" dia.
20" and over	10" dia.

- B. For flat oval and rectangular ducts, the nominal size of the access opening shall be:

When mounted on minor axis:

<u>Minor Axis</u>	<u>Access Opening</u>
8" thru 11"	8" x 12"
12" thru 13"	12" x 12"
14" and over	14" x 20"

When mounted on major axis:

<u>Major Axis</u>	<u>Access Opening</u>
8" thru 16"	8" x 12"
17" thru 24"	12" x 12"
25" and over	14" x 20"

- C. When used with insulated ducts, the access sections shall have glazed covers to prevent condensation.

2.14 DAMPERS

- A. Dampers of same materials as duct, as least one gauge heavier than duct, reinforced where directed, shall have an accessible location indicating quadrant, locking device for adjusting and locking dampers in position. Stiffen duct at damper location, install damper in manner to prevent rattling.
- B. Fire dampers shall be curtain type with fusible link. Curtain shall be fire mounted out of air stream. Dampers shall be furnished and installed at locations shown on plans, fire dampers constructed and tested in accordance with UL Safety Standard 555. Each fire damper shall have a 2 hour fire protection rating, 212° F fusible link, and shall include a UL label in accordance with established UL labeling procedures. Fire dampers shall be equipped for installation as required by the location shown. Fire dampers shall be installed in openings utilizing steel sleeves, angles, other materials, and practices required to provide an installation equivalent to that utilized by the manufacturer when dampers were tested at UL. Installation shall be in accordance with the fire damper manufacturer's instructions. Fire dampers shall be Ruskin type IBD2 or approved equal.
- C. Manual volume dampers shall be of the opposed blade type. They shall be furnished in sizes shown on plans. Frame and blades shall be 16-gauge galvanized steel with mill galvanized finish. Equal to Ruskin Model MD35.
- D. Automatic (motorized) dampers shall be of the parallel blade type. They shall be furnished in sizes shown on plans. Dampers shall be provided with solid stops for tight closing with sales on the blade edges and the sides of the damper frame which will stand a temperature of up to 20°F. These stops shall be so assembled that they may be easily replaced if they become damaged. Dampers shall be tight closing and shall be capable of less than 1% leakage based on an approach velocity of 1500 feet per minute. Equal to Ruskin No. DC350BES.
- E. Manufacturers: Dampers may also be manufactured by Greenheck, United Enertech, Air Balance, Arrow United Industries, Greenheck, Industrial Louvers, Louvers and Dampers, or Nailor-Hart.

2.15 INSULATIONS

- A. General: All insulation work shall be done by workmen thoroughly competent in this trade and employed by a full-time insulation contractor. Failure to finish work neatly, failure to vapor proof joints, ragged edges, failure to cover all fittings, valves, dents on surface, etc., shall be proper cause to reject this work. This Contractor shall call same to the attention of the Architect before such work has progressed beyond the point of economical correction.
- B. All material used shall be new and of first line quality and shall be as recommended by the manufacturer for the service intended. All insulation materials, including sealer material, adhesive, finishes, etc., shall be non-combustible. Complete installation shall be in accordance with manufacturer's requirements.
- C. This Contractor shall be responsible for the removal from the site of all excess materials, cartons, scrap, etc. He shall protect equipment installed by others, cleaning such equipment should mortar, plaster, adhesive, etc., fall on same.
- D. The following service shall be insulated with the listed thickness of materials:

SERVICE	INSULATION MATERIAL	THICKNESS	FINISH
Air Separator, Chilled Water Expansion Tank & Water Box of Chilled Water Pumps	Sheet Armaflex	1-1/2"	All service jacket (indoors) Stainless Steel jacket (outdoors)
Condensate Drain Piping	Armaflex Type ER	3/8"	Paint with acrylic protective paint where exposed to sun
Single Wall Spiral Round, Flat Oval, & Rectangular Ductwork (Concealed)	1 lb. density blanket type fiberglass duct	2"	Reinforced aluminum foil
Chilled Water Supply & Return Above Grade	Foam glass sectional	1 1/2"	FRJ jacket (indoors) Stainless Steel jacket (outdoors)
Rectangular Supply Ductwork (Exposed in Mechanical Room)	Glass Fiber Rigid Insulation	2"	FSK Facing

- E. Underground chilled water piping shall be insulated with pre-insulated underground piping system as hereinafter specified.
- F. All Armaflex insulation shall be slipped over piping with all joints sealed with an approved mastic.

- G. All insulation shall be installed as per material manufacturer's printed instructions. All valves, fittings, strainers, Pete's plugs, etc., shall be insulated with molded fittings of same material as piping and plastic fitting covers installed over all fittings. Insulation shall be Owens-Corning Fiberglass, Knauf or approved equal, as scheduled above. All materials, jackets, adhesives, etc., shall meet smoke developed ratings and fire classifications of UL.
- H. Insulation subcontractor shall submit complete product data brochures on insulation materials, jackets, finishes, mastics, cements, etc., for approval along with complete installation brochures for all materials used on this project. Installation methods shall be in accordance with printed instructions from material manufacturers.
- I. It shall be the responsibility of the insulating subcontractor to coordinate hanger locations and prevent crushing or breaking finishes.
- J. All chilled water and hot water piping exterior of building shall be covered with 18-gauge 304 stainless steel jacket over insulation. Coordinate insulation with heat tracing.
- K. All insulation materials, jackets, adhesives, coatings, etc., shall meet the Underwriters' Laboratories fire hazard classification (UL 723), for flame spread rating of 25, smoke developed rating of 50, and fuel contributed rating of 50.
- L. Interior lined flat oval supply ductwork from air handling units shall be wrapped with 1 LB density 1-1/2" thick insulation from point of unit connection to point of 2" thick exterior duct wrap. Insulation shall be attached with mechanical stick pin fasteners in addition to cement.
- M. Pipe insulation shall have tightly butted joints, taped seams to cover the entire system, including air vents.
- N. All rectangular supply duct, regardless of pressure classification, shall be insulated with a 2" thick, 1 lb. density (R=6) duct wrap. Wrap exhaust duct with 1-1/2" thick, .75 lb. density (R=4.2) duct wrap. The internally lined spiral duct shall not require ductwrap.
- O. Glass fiber rigid duct insulation board shall be 6-pound density with FSK facing. Cut to fit between standing seams and stiffeners to provide 1/2" minimum cover, and secure to ducts with 100% coverage of duct insulation adhesive and mechanical fasteners on 12" centers. Butt joints. Tape all joints and pin penetrations with 4" wide FSK tape after pointing up clip penetrations with insulating cement.

2.16 DRAIN CONNECTIONS

- A. Provide drain connection with deep seal trap for all cooling coils at air handling units. See plans for trap depths. Drain piping shall be Schedule 40 PVC pipe with drainage pattern fittings and cement mastic joints insulated with 3/8" wall closed cell elastomeric insulation slipped over piping. Drain piping passing through a fire rated barrier shall be metal and fire rated (i.e. steel, copper, etc.). Slope piping at 1/4" per foot to nearest floor drain. Refer to plumbing plans for location of floor drains. Insulate all drain piping.

2.17 PRE-INSULATED UNDERGROUND PIPING SYSTEM

- A. Contractor shall provide a pre-insulated/pre-fabricated piping system similar and equal to Thermacor Process, Inc., Ferrotherm System or Perma-Pipe. Other acceptable manufacturers shall include Rovanco.
- B. Insulation shall be foamed polyurethane completely fitting the annular space and shall be a minimum of 0.75" thick with a uniform density of 1.9-2.1 pounds per cubic foot, and minimum 90% closed cell structure.
- C. Jacketing materials shall be PVC with a minimum wall thickness of 0.060".
- D. Carrier pipe shall be standard pipe lengths of Schedule 40 ASTM A53 black steel with pipe ends bared for welding. All unloading and handling shall be done so as to protect the outer jacket bared pipe ends at all times. Pre-insulated piping shall terminate 6" above floor slab in mechanical room.
- E. Joints and fittings on steel piping shall be insulated in accordance with manufacturer's specifications.
- F. Elbows and anchors where indicated on drawings shall be pre-fabricated and field insulated by contractor with factory supplied field closer kits.
- G. The trench for buried systems will be a minimum of 12" wider than the pre-insulated joint and a minimum of 4 feet deep. The trench base and all backfill within 6" of the piping system shall be free of any debris. Proper testing shall be carried out before any pipe is buried.
- H. Prior approval of piping system will be required before submitting a proposal on this project.
- I. Complete installation instructions shall be submitted by manufacturer along with shop drawings for approval. Field verify dimensions and routing. Locate all subsurface utilities.

2.18 TRENCHING AND BACKFILLING

- A. General: Excavate straight and true with bottom uniformly sloped to low points.
- B. Trench Depth: Excavate trenches to a depth of 4 feet minimum finished grade unless otherwise indicated.
- C. Minimum Coverage: Provide the following minimum cover over top of installed piping:

Pre-insulated piping	3'-6"
Field insulated piping	2'-0"
- D. Backfill: Backfill with clean materials from excavation. Remove organic material as well as rocks and debris larger than 1" diameter. Place acceptable backfill material in 6" lifts, compacting each lift.

- E. Pavements: Were existing pavements are cut to install underground distribution system, cut smoothly to straight lines 6" wider than trench.
- F. Excavate trench to required depth and width.
- G. At curbs, backfill with dry and fill material, placing in 6" lifts.

2.19 PIPE HANGERS, SUPPORTS, ETC.

- A. Support all piping from building structure with hangers fastened to structural deck. Hangers shall be located on points not to exceed the following maximum span with all thread rods or diameter shown. This does not apply to PVC piping.

1 1/4" pipe and smaller	Max. span 7', hanger rod 3/8"
1 1/2" pipe	Max. span 9', hanger rod 3/8"
2" and larger pipe	Max. span 10', hanger rod 1/2"
3" and larger pipe	Max. span 12', hanger rod 5/8"
All PVC piping	Max. span 4', hanger rod 3/8"

- B. Pipe hanger selection and application shall conform to the Manufacturer's Standardization Society of the Valves and Fittings Industry Publication Sp-69, Materials Design, and Manufacturer's Publication SP-58. See "Mechanical General Requirements" for additional requirements.
- C. Supports used on steel or cast iron pipe shall be malleable iron or steel.
- D. Where pipe hangers penetrate fire rated barriers at the underside of the joists, seal openings around hangers with UL approved fire caulking equal to barrier rating.
- E. Where necessary to prevent transmission of vibration, supports with vibration suppressors shall be installed as required.
- F. Wherever pipe passes through walls above grade, 10-gauge galvanized steel sleeves of the proper size and length shall be provided. Where pipe is insulated, sleeves shall be large enough to accommodate insulation.
- G. Wherever pipes pass through finished floors, walls, or ceilings, provide chromium plated brass escutcheons. Escutcheons or insulated lines shall be large enough to extend around insulation. All escutcheons shall be firmly attached to pipe and shall cover entire masonry opening.
- H. Anchors shall be installed on pipe lines where necessary to control direct expansion or contraction.
- I. Hangers on insulated lines shall be large enough to accommodate the insulation. Saddles and spacers shall be provided at all pipe hangers. Hangers shall be provided at all pipe supports. Do not support piping from other piping.

- J. Insulation protector shields of 20-gauge steel, 18" long and extending half around insulated pipe shall be used at all hanger points. Provide wooden spacers of thickness equal to insulation between pipe and hanger.

2.20 PIPING INSTALLATION

- A. Pipe shall be cut accurately to measurements established at the building, and shall be worked into place without springing or forcing, properly clearing all windows, doors, and other openings. Excessive cutting or other weakening of the building structure to facilitate piping installation will not be permitted. All changes in direction shall be made with fittings. All pipes extending through the roof shall be flashed by this Contractor, but counter flashed by the roofing contractor. Piping connections to equipment shall be in accordance with details shown on the drawings. All open ends of the pipe lines or equipment shall be properly capped or plugged during installation to keep dirt or other foreign material out of the system.
- B. Service valves shall be installed where required for the proper servicing of the equipment. All joints between sections of pipe and between pipe and fittings 2 1/2" and larger shall be fusion welded. The welding shall be in accordance with the recommendations of the American Welding Society. All such changes in direction and intersections of lines shall be made with welding fittings, except as otherwise specifically permitted hereinbefore. Mitering of pipe to form elbow, notching straight runs to form tees, or any similar construction will not be permitted. Cement solvent fittings shall be installed on all PVC piping.
- C. Threadolets and weldolets may be used where branch size is less than one-half the main size.
- D. Joints: All screw joints shall be made with tapered threads properly cut. Screw joints shall be made perfectly tight with a stiff mixture of graphite and oil, applied with a brush to the pipe threads only, and in no case to the fittings. All flange joints shall be faced true, packed and made up perfectly square and tight.
- E. All piping systems shall be pressure tested at 150 psi as hereinafter specified.
- F. This Contractor shall provide for expansion and contraction of all piping installed by him and must make proper provisions so that there will not be undue strain on any part of the piping or any work installed by others.
- G. All lines shall be of sizes indicated, shall run approximately where shown on plans. Water lines shall grade downward against the direction of flow 1" in 30 lineal feet of run.
- H. The high points of all forced water mains and branches shall be manually vented. Copper drain lines from manual air vents shall be extended to nearest floor drain or as directed by Architect.
- I. All changes in pipe size shall be made with reducing fittings or couplings. No bushings will be allowed.

- J. Unions shall be provided adjacent to all valves and mechanical equipment receiving screwed pipe and companion flanges shall be provided on all flanged valves, pumps, and other mechanical equipment.
- K. All piping systems shall be flushed with clean water and all strainer baskets thoroughly cleaned before placing into operation. Flushing shall be witnessed by Architect.
- L. Piping Materials: Piping materials to be of domestic standards, new and free of defects. Piping certification shall be provided upon request of Engineer.
- M. The following classification of piping shall be used on the following services:
 - 1. Chilled Water Piping-Schedule 40 black steel, ASTM A53, Grade
 - 2. Drain Piping - Schedule 40 PVC pipe.
 - 3. Cold Water Piping - Type "L" hard drawn copper.
- N. Heat trace all piping exposed to weather with electric heat cable. Cable to be 120 volt self-regulating type with 3.8 watts per linear foot. Cable shall be rated for 500°F and shall be 15-gauge outside diameter with teflon insulation. Cable shall be equal to Raychem Type XL and shall be installed in accordance with manufacturer's requirements. Coordinate power requirements with Electrical Contractor.
- O. Fittings: All fittings shall be new, free of defects and of the following types for service listed:
 - 1. For chilled water piping - 2" and smaller, 150# screw pattern, black malleable in accordance with WW-P-521. 2 1/2" and larger, steel welding fittings, long radius type.
 - 2. For water piping - wrought copper sweat pattern.
 - 3. Drain piping - 150 psi PVC cement joint fittings.
- P. Unions: Unions shall be installed at all locations shown on drawings. For 2" and smaller on systems with 150# fittings, use 150# ground joint screw pattern unions. For welded systems, use 150# flanges.

2.21 VALVES AND COCKS

- A. Valves shall be manufactured by Crane, Jenkins, Milwaukee, Nibco, Red-White or Stockham. Valves shall be equal to the following:

Gate Valves: 2 1/2" and Larger - 125#, Stockham No. G612
 2" and Smaller - 125#, Stockham No. B-105

Ball Valves: 2 1/2" and Larger-125#, Stockham No. S214-BR-TT
 2" and Smaller - 150#, Stockham No. S216-BR-RT

Check Valves: 2 1/2" and Larger - 150#, Stockham No. G-931
 2" and Smaller - 200#, Stockham No. B-435

Globe Valves: 2 1/2" and Larger - 125#, Stockham No. G-512
 2" and Smaller - 200#, Stockham No. B-22

Butterfly

Valves: 2 1/2" and Larger - 200#, Stockham No. LG512-DS3-B

- B. Provide extended neck for all valves to allow for proper installation of insulation. Provide exposed tag for valve with manufacturer, model, size, and unit served.
- C. Globe valves shall be used for balancing hot water service. Globe valves shall be used for balancing chilled water service on 2" and smaller pipes. Butterfly valves shall be used for balancing chilled water service on 2 1/2" and larger pipes. Ball valves may be used in lieu of gate valves 4" and smaller. Flow Design, Inc. flow set balancing system with valves, strainers, P/T plugs, unions, and venturi flow meter may be provided by single manufacturer at contractor's option.

2.22 SPECIALTIES, PIPING SYSTEM

General Note: Mechanical contractor shall coordinate final location of all specialty equipment in field. All equipment to be installed outdoors exposed to weather shall be selected for the application whether specified or not.

- A. Strainers shall be provided before each control valve and each pump. Strainers to be Sarco Type AT with brass mesh for water operation.
- B. Thermometer wells shall be stainless steel 3/4" NPT with extension neck, cap and chain equal to Trerice #5370.
- C. Gauge Cocks shall be Trerice Model 380, 1/4" size with union connection. Provide 1/4" plug in gauge openings.
- D. Thermometers: Pipe thermometers to be 9" adjustable angle type with aluminum case. Size to be 3/4" brass separable socket type with extension neck type stainless steel well. Unit to be Trerice BX Series. Range to be 0 - 100°F for chilled water and 30 - 240°F for hot water. Duct thermometers to be Trerice B 80,000, range 09 - 180°F, 5" dial.
- E. At all cooling coils, provide pressure/ temperature indicating devices, 1/4" NPT with extended neck equal to "Pete's Plugs" as manufactured by Peterson Engineering Company. Provide cap with chain.
- F. Gauges: Gauges to be 4 1/2" dial cast aluminum cast with range from 30" vacuum to 60 psi. Provide Trerice #835 needle valve at each gauge. Unit to be equal to Trerice Series 500 X. Vents on water system - Hoffman No. 79 or approved equal.
- G. Expansion Tank: Construction shall be fabricated steel designed and constructed per ASME code requirements. Bladder shall be heavy duty and shall be removable for vertical mounting and operation up to 125 psig working pressure and 240° F operating temperature. Manufacturer shall be Armstrong, Bell and Gossett, Taco or Wheatley.
- H. Air Separator: Construction shall be fabricated steel designed and constructed per ASME code requirements. Air separator shall have NPT or flanged connections as required. Air separator

shall have separate top fittings for connection to system expansion tank and for air vent. There shall be a separate bottom connection for blowdown cleaning. Manufacturer shall be Armstrong, Bell and Gossett, Taco or Wheatley.

- I. Equipment selection shall be suitable for outdoor installation.
- J. Water pressure reducing valves, Bell and Gossett No. 7 or approved equal, set at 25 psi.
- K. ASME Safety Relief Valves: Bell and Gossett No. 5 or approved equal, set to 40 psi.
- L. Flexible pipe connectors shall be furnished and installed where indicated in specifications and/or on drawings. Flexible connectors shall be 300 series stainless steel braided type manufactured by Flow Design, Inc., Keflex, Metra-Flex, Resisto-flex, Southeastern Hose or approved equal. Joints shall be suitable for pressure and temperature of fluid handled.
- M. At Contractor's option suction diffusers may be used at all pumps to replace valves and strainers.

2.23 PIPE MARKERS

- A. Contractor shall furnish and install pipe markers with flow directions and codes on the following services in all locations:

<u>Service</u>	<u>Code</u>	<u>Background Color</u>	<u>Letters</u>
Chilled water supply	CWS	Green	White
Chilled water return	CWR	Green	White
Condensate drain	CD	Green	White

- B. Pipe markers shall meet ANSI Standards and shall be equal in all respects to Sexton Name Plate Corporation's Setmark System.
- C. Pipe markers shall be installed at twenty foot intervals throughout the entire system regardless of location.

2.24 AUTOMATIC SHUT-DOWN

- A. Air conditioning equipment shall have smoke detectors installed in supply and return air duct. Mechanical contractors shall install smoke detectors provided by electrical contractor under Division 26000. Smoke detectors shall be for automatic shut down of unit.

2.25 LOUVERS

- A. Louvers shall be stationary type. Furnish and install louvers as hereinafter specified where shown on plans. Louvers shall be "Wind Driven Rain Resistant" type with a drain gutter in each blade and down spots in jambs and mullions. Stationary drainable blades shall be contained within a single 5" frame.

- B. Louver components (heads, jambs, sills, blades, and mullions) shall be factory assembled by the louver sections to provide overall sizes required.
- C. Construction shall be of extruded aluminum alloy as follows:
 - Frame: .125" wall thickness
 - Blades: .125" wall thickness at 37E angle on approximately 4 1/2" centers
 - Screen: Aluminum insect in removable frame.
 - Wind Loads: Basic Wind Speed: 150 mph
Importance Factor: 1.15.
Exposure Category: B.
- D. SUBMITTALS - Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of louver assembly.
 - 1. Wind-Borne Debris Impact Resistance Performance: Notice of Acceptance from Miami-Dade Building Code Compliance Office or Certification of Compliance from other testing laboratories approved by the State of Florida under the Florida Building code.
 - 2. AMCA 540 listed for wind borne debris impact resistance.
 - 3. AMCA 550 listed for high velocity rain resistance.
- E. QUALITY ASSURANCE - Louver units indicated for exterior locations shall be designed to comply with the requirements of the High-Velocity Hurricane Zone of the 2017 Florida Building Code. Notice of Acceptance from Miami-Dade Building Code compliance Office or certification from other testing laboratories approved by the State of Florida under the Florida Building Code shall be provided for review.
- F. ALUMINUM FINISHES - High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.
- G. Published louver performance data bearing the AMCA Certified Ratings Seal for Air Performance & Water Penetration must be submitted for approval. Provide birdscreen and flanged frame. Provide baked enamel finish with color as selected by Architect. Louvers shall be Ruskin Model EME6325D or equal by American Warming, Arrow United Industries, Dowco, Greenheck, Industrial Louvers, Louvers and Dampers, or Nailor-Hart.

PART 3 - EXECUTION

3.1 WATER TREATMENT

- A. General: This Contractor shall be responsible for acquiring the services of a water treatment service to supply all equipment, lab services, field investigations, tests, and one (1) year's supply of chemicals to accomplish the following:
 - 1. Chilled water and hot water systems shall be treated by a factory fabricated one shot feeder of two quart capacity installed as indicated. Furnish one year supply of the recommended chemical formula to prevent scale and corrosion of closed recirculating system. Furnish the recommended test kit to control treatment residual.
 - 2. Provide test kits, laboratory and technical assistance and field investigations for one (1) year period. Instruct Owner's operating personnel of proper operation of all equipment.

3.2 TESTING AND BALANCING

- A. Testing and balancing procedures shall be conducted under the Mechanical Contractor's contract. The Mechanical Contractor shall be responsible for correcting deficiencies identified in test and balance report. Mechanical Contractor shall also be responsible for all adjustable belt drive sheaves being replaced with fixed sheaves once test and balance procedures have been completed.

3.3 TEMPERATURE CONTROL SYSTEM

- A. The automatic temperature controls (ATC) portion of this project as specified under Section 23 09 00 shall be included in the base bid by the Mechanical Contractor.
- B. Controls shall be provided and installed under the supervision of the ATCS contractor responsible for warranty and servicing of the system.
- C. It shall be the Division 23 contractors responsibility to include all costs in his bid, associated with the controls work. These shall include but not be limited to the following:
 - 1. Installation of dampers and blankoffs as required.
 - 2. Installation of all control valves.
 - 3. Installation of sensor valves.
 - 4. Installation of air flow measuring stations and/or CO2 sensors.
 - 5. Starters with control transformers and HOA switches as specified in the mechanical sections.
 - 6. Chiller remote temperature reset ATC interface for water chillers.
 - 7. Variable frequency drives.

3.4 GUARANTEE

- A. The Contractor shall guarantee, in writing, the entire system when completed to be free from any and all defects and shall guarantee the entire system, controls and other equipment against defective materials and workmanship for a period of one (1) year from date of completion and acceptance.

- B. Upon receipt of notice from the Owner of the failure or any part of the guaranteed equipment during the guarantee period, the affected part or parts shall be promptly repaired or replaced with new parts by and at the expense of the Contractor.

- C. Under the guarantee clause, the Contractor shall include free routine maintenance for a period of one (1) year from the date of final acceptance. At the end of one year of operation, the mechanical contractor shall inspect and repair any problems which may exist. Contractor shall lubricate bearings, adjust or replace belts, replace filters, and provide all necessary preventative and corrective maintenance required. Contractor shall provide Engineer with a table identifying each air handling unit model and serial number, quantity and size of filters, filter manufacturer and efficiency, belt manufacturer and size, motor HP, frame, and power supply.

END OF SECTION 23 80 00

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SECTION 26 01 00 – ELECTRICAL GENERAL REQUIREMENTS

I. GENERAL

1. JOB CONDITIONS:

- A. **SITE INSPECTIONS:** Before submitting proposals, each bidder should visit the site and fully familiarize himself with all job conditions and shall be fully informed as to the extent of his work. No consideration will be given after bid opening date for alleged misunderstanding as to the requirements of work involved in connecting to the utilities or as to requirements of materials to be furnished.
- B. **EXISTING CONDITIONS:** All utilities, existing system and conditions shown on the plans as existing are approximate, and the Contractor shall verify before any work is started.
- C. **SCHEDULED INTERRUPTIONS:** Planned interruptions of utilities service, to any facility affected by this contract, shall be carefully planned and approved by Architect at least ten (10) days in advance of the requested interruption. The Contractor shall not interrupt services until the Architect has granted specific approval. The request shall indicate services to be affected, date and time of interruption and duration of outage. Request for interruption of service will not be approved until all equipment and materials required for the completion of that particular phase of work are on the job site. The work will have to be scheduled after normal working hours.
- D. **ACCIDENTAL INTERRUPTIONS:** All excavation and/or remodeling work required shall be performed with care so as not to interrupt other existing services (water, gas, electrical, sewer, sprinklers, etc.). If accidental utility interruption resulting from work performed by the Contractor occurs, service shall be immediately restored to its original condition without delay, by and at the expense of the Contractor, using skilled workmen of the trade required.
- E. **MAINTAINING SERVICE:**
 - a. Any existing service (or operating system) which must be interrupted for any length of time shall be supplied with a temporary service if necessary, for continuation of the normal operation of this facility.
 - b. Any existing system or part of an existing system currently in operation shall remain so after all additions or renovations are made, and all work is complete.

2. REGULATORY REQUIREMENTS:

- A. **CODES, PERMITS AND INSPECTIONS:** The installation shall comply with all state and federal laws and ordinances applicable to electrical installation and with the regulations of the latest published edition of the National Electric Code where such regulations do not conflict with those laws and ordinances. The Contractor shall obtain permits, and after completion of the work, shall furnish the Architect a certificate of final inspection and approval from

the applicable local inspection department. Make necessary changes to plans and specifications to meet code standards at no additional cost to the Owner. Any charges by a utility for providing service as shown shall be included in the bid and paid by the Contractor including any additions or revisions in service locations or details. For Schools: The installation shall comply with all state and federal laws and ordinances applicable to electrical installation and with the regulations of the latest published edition of the National Electric Code. The installation shall also conform to the latest published edition of State Requirements for Educational Facilities (SREF).

- B. DRAWINGS AND SPECIFICATIONS: The drawings and these specifications are complementary each to the other. What is called for by one shall be as binding as if called for by both. Omissions from the drawings and specifications of details of work which are evidently necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such work. In any case of discrepancy in the figures or catalog numbers, the matter shall be submitted to the Architect, who shall promptly make a determination in writing. Any adjustment by the Contractor shall be at the Contractor's own risk and expense. Electrical drawings are diagrammatic only. Do not scale these drawings. All equipment shall be installed in accordance with manufacturer's recommendations and any conflicting data shall be verified before bidding.

3. COOPERATION:

- A. INTERFACING WITH OTHER CRAFTS: It shall be the responsibility of the Contractor to cooperate and coordinate with all other crafts working on this project. This Contractor shall do all cutting, trenching, backfill and structural removals to permit entry of the electrical system components. The Construction Manager shall do all patching and finishing. The Architect's representative shall render a decision in writing as to space allotment in congested areas. No claims for "extras" due to such decisions shall be allowed, even though the work has already been installed. When the Contractor submits for approval any item or equipment, he shall determine for himself whether or not it will fit the space provided. If, after installation of any equipment, wiring or other items, it is determined that ample maintenance or passage space has not been provided, then the Contractor shall rearrange this work and/or furnish other equipment even though the equipment installed has been approved.
- B. EQUIPMENT FURNISHED UNDER OTHER SECTIONS: This Contractor shall furnish and install, complete electrical roughing-in and connections to all equipment furnished under other sections and as indicated on drawings. This includes all outlets as shown on mechanical and electrical drawings. All such equipment shall be set in place as work of other sections.
- C. HEATING AND AIR CONDITIONING:
 - a. The Contractor shall furnish all branch circuit wiring to motors and control panels or centers including disconnects, receptacles, switches, and appurtenances to which the system at the units may be connected, to provide a complete system of wiring for power. Control equipment and control circuit wiring is specified in the Mechanical Section.

- b. Control devices to be included in the branch circuit, except those furnished integrals with the equipment, will be delivered by the Heating and Air Conditioning Contractor and installed by the Electrical Contractor.
4. WORKMANSHIP: All work shall be executed in a neat and substantial manner by skilled workman, well qualified, and regularly engaged in the type of work required. Substandard work shall be removed and replaced by the Contractor at no cost to the Owner.
5. APPROVAL OF MATERIALS AND EQUIPMENT:
 - A. SUBMITTALS:
 - a. Shop Drawings: The Contractor shall submit a list of items proposed for use. He shall also submit catalog data and shop drawings on proposed systems and their components, panelboards, safety switches, starters and contactors, transformers, lighting fixtures, and wiring devices. Where substitutions alter the design or space requirements, the Contractor shall defray all items of cost for the revised design and construction including costs to all allied trades involved.
6. PRODUCT DELIVERY, STORAGE AND HANDLING
 - A. PROTECTION: Take necessary precautions to protect all material, equipment, apparatus and work from damage. Failure to do so to the satisfaction of the Architect will be sufficient cause for the rejection of the material, equipment or work in question. Contractor is responsible for the safety and good condition of the materials installed until final acceptance by the owner.
 - B. CLEANING: Conduit openings shall be capped or plugged during installation. Fixtures and equipment shall be tightly covered and protected against dirt, moisture, chemical and mechanical injury. At the completion of the work the fixtures, material and equipment shall be thoroughly cleaned and delivered in condition satisfactory to the Architect.
7. TESTING AND BALANCING
 - A. Make tests that may be required by the Owner or the Architect in connection with the operation of the electrical system in the buildings. Balance all single-phase loads connected to all panelboards in the buildings to insure approximate equal divisions of these loads on the main secondary power supply serving the buildings. All tests shall be made in accordance with the latest standards of the IEEE and the NEC.
8. OPERATING AND MAINTENANCE INSTRUCTIONS/AS BUILT DRAWINGS:
 - A. Project a digital copy and 1 – hard copy of operating instructions.
 - B. Upon completion of the work and at the time designated, Contractor shall instruct the representative of the Owner in the operation and maintenance of the systems.
 - C. This Contractor shall provide as-built Drawings at the completion of the job. Drawings shall show all significant changes in equipment, wiring, routing, location, etc. All underground conduit routing shall be accurately indicated with locations dimensioned.

9. GUARANTEE AND SERVICE: Upon completion of all tests and acceptance, the Contractor shall furnish the Owner a written guarantee covering the electrical work done for a period of one (1) year from date of acceptance. Guarantee includes equipment capacity and performance ratings specified without excessive noise levels. Upon notice from the Architect or the Owner, the Contractor shall, during the guarantee period, rectify and replace any defective material or workmanship and repair any damage caused thereby without additional cost.

END OF SECTION 16000

SECTION 26 01 10 – ELECTRICAL BASIC MATERIALS AND METHODS

I. GENERAL

1. SECTION INCLUDES:

- A. SUPPORTS
- B. EXCAVATION, TRENCHING, AND BACKFILLING
- C. CUTTING AND PATCHING
- D. EQUIPMENT CONNECTION
- E. IDENTIFICATION OF EQUIPMENT
- F. CLEANING AND PAINTING

II. PRODUCTS

1. SUPPORTS:

- A. FRAMING STEEL: Galvanized or painted rolled steel of standard shapes and sizes.
- B. MANUFACTURED CHANNEL: Hot dipped galvanized with all hardware required for mounting as manufactured by Unistrut, Steel City, or approved equal.
- C. MISCELLANEOUS HARDWARE: Standard sizes treated for corrosion resistance.

2. IDENTIFICATION:

- A. NAMEPLATES: Laminated black micarta with ¼" high engraved white letters.
- B. PANEL DIRECTORIES: Typewritten under plastic cover.
- C. WIRE AND CABLE MARKERS: Cloth, split sleeve, or tubing type.

III. EXECUTION

1. INSTALLATION

- A. Products shall be installed in accordance with manufacturer's instructions.
- B. Install support systems sized and fastened to accommodate weight of equipment and conduit, including wiring, which they carry.

- a. Fasten hanger rods, conduit clamps, and outlet junction boxes to building structure using pre-cast insert system, expansion anchors, preset inserts, beam clamps, or spring steel clips.
 - b. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion and anchors on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
 - c. Do not fasten supports to piping, ceiling support wires, ductwork, mechanical equipment, or conduit.
 - d. Do not use powder-actuated anchors.
 - e. Do not drill structural steel members without written consent from the Architect.
 - f. Fabricate supports from structural steel or steel channel.
 - g. Install surface mounted cabinets and panel boards with minimum of four anchors.
 - h. Provide steel channel supports to stand cabinets one inch off wall in wet locations.
 - i. Bridge studs top and bottom with channels to support flush mounted cabinets and panel boards in stud walls.
- C. Excavating, trenching, and backfilling shall be accomplished as indicated on the Drawings or where required to install systems and/or equipment.
- a. Trenches for all underground conduits or equipment shall be excavated to the required depths. Where soft, wet, or unstable soil is encountered, the bottom of the trench shall be filled with 6 inches of compacted gravel and sand fill. All trench bottoms shall be tamped hard. Trenches shall be shored as required to meet OSHA requirements and general safe working conditions.
 - b. After conduits or equipment have been inspected and approved by the Architect and prior to backfilling, all forms shall be removed, and the excavation shall be cleaned of all trash and debris. Material for backfilling shall consist of the excavation, or borrow of sand, gravel, or other materials approved by the Architect and shall be free of trash, lumber or other debris. Backfill shall be placed in horizontal layers, not exceeding 9 inches in depth and properly moistened to approximate optimum requirements. Each layer shall be compacted by hand, or machine tamped to a density equivalent to surrounding soil. Backfill shall be brought to suitable elevation above ground to provide for

anticipated settlement and shrinkage. All paving broken up shall be repaired and returned to the original condition.

- c. All underground conduits shall have an underground (metal foil) tape installed 12 inches above conduit identified as ELECTRICAL to aid in future location of conduit.
 - d. All underground conduits shall have an underground red tape installed 12" above conduit.
- D. CUTTING AND PATCHING: This Contractor shall provide all cutting, digging, etc., incident to his work and shall make all required repairs thereafter to the satisfaction of the Architect, but in no case shall the Contractor cut into any major structural element, beam, or column without written approval of the Architect.
- a. Pavements, sidewalks, roads, curbs, walls, ceilings, floors, and roofs shall be sawcut, patched, repaired and/or replaced as required to permit the installation of the electrical work. Existing concrete floors and other slabs, which require vertical piercing for installation of conduit raceways shall be neatly core drilled. The Contractor shall carefully lay out his drilling in advance and arrange it to minimize exposed work.
 - b. The Contractor shall bear the expense of all cutting, patching, painting, repairing, or replacing of the work of other trades required because of his fault, error, or tardiness or because of any damage done by him.
 - c. All patching, and finishing shall be performed as directed by the Construction Manager.
- E. Make electrical connections to equipment in accordance with equipment manufacturer's instructions.
- a. Verify that wiring and outlet rough-in work is complete, and that equipment is ready for electrical connection, wiring, and energization.
 - b. Make wiring connections in control panel or in wiring compartment of pre-wired equipment. Provide interconnecting wiring where indicated.
 - c. Install and connect disconnect switches, controllers, control stations, and control devices as indicated.
 - d. Make conduit connections to equipment using flexible conduit. Use liquid-tight flexible conduit in damp or wet locations.
 - e. Install prefabricated cord set where connections with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.

- f. Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.
- F. Identify electrical distribution and control equipment, and loads served, to meet regulatory requirements and as specified herein.
- a. Degrease and clean surface to receive nameplates.
 - b. Secure nameplates to equipment fronts using screws or rivets with edges parallel to equipment lines.
 - c. Each panel shall have an external nameplate (with the exception of panels exposed in the corridors which shall be internally labeled). Disconnect switches, starters or similar devices shall have a micarta engraved nameplate mechanically affixed indicating the load served and the location, such as "A/C 2" or "A/C 3 above ceiling". Letters shall be ¼" white on a black background. Panels shall be designated in this manner:

"Panel A
120/208 Volts
3 Phase 4 Wire
Served from Panel MP"
 - d. Panel directories shall accurately indicate load served and location of load. Provide new corrected typed directories for all modified panels.
- G. Install wire markers on each conductor in panel board gutters, boxes, and at load connections.
- a. Use distribution panel and branch circuit or feeder number to identify power and lighting circuits.
 - b. Use control wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings to identify control wiring.
- H. Cleaning and Painting: The respective Contractors for the various phases of work shall clear away all debris, surplus materials, etc., resulting from their work or operations, leaving the job and equipment furnished in the clean first-class condition.
- a. All fixtures and equipment shall be thoroughly cleaned of plaster, stickers, rust, stains and other foreign matter or discoloration, leaving every part in an acceptable condition ready for use.
 - b. The Contractor shall refinish and restore to the original condition and appearance, all electrical equipment, which has sustained damage to manufacturer's prime and finish coats or enamel or paint. Materials and

workmanship shall be equal to the requirements described for other painting.

END OF SECTION 16100

SECTION: 26 02 00 - RACEWAY SYSTEMS

I. GENERAL

1. SECTION INCLUDES:

- A. CONDUIT AND CONDUIT FITTINGS
- B. ELECTRICAL BOXES AND FITTINGS

II. PRODUCTS

1. CONDUIT AND FITTINGS:

A. CONDUIT:

- a. Metal conduit rigid: Galvanized steel.
- b. EMT: Galvanized steel.
- c. Flexible Conduit: Steel.
- d. Liquid-tight Flexible Conduit: Flexible steel conduit with PVC jacket.
- e. Plastic Conduit and Tubing: NEMA TC 2; PVC. Schedule 40 conduit.

B. CONDUIT FITTINGS:

- a. Conduit Fittings and Conduit Bodies: NEMA FB 1. Conduit fittings to be steel threaded type.
- b. Tubing Fittings: NEMA FB 1. Tubing fittings to be steel compression type or steel set screw type.
- c. Flexible Conduit Fittings: NEMA FB 1. Flexible conduit fittings to be steel set screw or screw-in type.
- d. Liquid-tight Flexible Conduit Fittings: NEMA FB 1. Liquid-tight flexible conduit fittings to be steel compression type.
- e. Plastic Fittings and Conduit Bodies: NEMA TC 3.

2. ELECTRICAL BOXES:

A. BOXES:

- a. Sheet Metal: NEMA OS 1; galvanized steel 4" or 4-11/16" square. Provide galvanized plaster/tile ring for recessed outlet boxes.
- B. LARGE ENCLOSURES: NEMA 250; Type 4, steel enclosures with manufacturer's standard enamel finish and cover, held closed screws.
- C. Ground mtd pull boxes shall be quazite (or equal) as indicate4d on the drawings.

III. EXECUTION

1. EXAMINATION AND PREPARATION:

- A. Examine supporting surfaces to determine that surfaces are ready to receive work.
- B. Electrical boxes shown on Drawings are approximate locations unless dimensioned. Obtain verification from Architect of floor box locations and locations of outlets prior to rough-in. Outlets may be relocated to a distance of ten feet prior to rough-in with no additional cost to the Owner.

C. 2. INSTALLATION:

- A. Use conduit and tubing for raceways in the following locations:
 - a. Underground Installations: Schedule 40 PVC.
 - b. Installations in Concrete: Rigid non-metallic conduit (schedule 40).
 - c. Exposed Outdoor Locations: Rigid steel conduit or schedule 80 PVC.
 - d. Wet Interior Locations: Rigid steel conduit, IMC, or electrical metallic tubing. Use threaded or raintight fittings for conduit.
 - e. Concealed Dry Interior Locations: Rigid steel conduit or electrical metallic tubing.
 - f. Exposed Dry Interior Locations: Rigid steel conduit or electrical metallic tubing.
 - g. Flexible Conduit: Use flexible metal conduit for connections to motors (and similar equipment) and for connections to lighting fixtures. Flexible conduit shall not be over 6' long. Note that MC cable may be used for fixture whips not over 6' long.
- B. Size raceways for conductor type installed.
 - a. Minimum Size Conduit: 3/4" in underground locations, 1/2" in all other locations. (Minimum conduit size for fire alarm or tele/data or security systems shall be 3/4".)

- C. Arrange conduit and tubing to maintain headroom and to present a neat mechanical appearance.
 - a. Route exposed raceway parallel and perpendicular to walls and adjacent piping.
 - b. Maintain minimum 6-inch clearance to piping and 12 inch clearance to heat surfaces such as flues, steam piping, and heating appliances.
 - c. Maintain required fire, acoustic, and vapor barrier rating when penetrating walls, floors, and ceilings.
 - d. Route conduit through roof openings for piping and ductwork where possible; otherwise, route through roof jack with pitch pocket.
 - e. Group in parallel runs where practical. Use rack constructed of steel channel. Maintain spacing between raceways or de-rate circuit ampacities to NFPA 70 requirements.
 - f. Use conduit hangers and clamps; do not fasten with wire or perforated pipe straps.
 - g. Terminate all conduits with insulated bushings.
 - h. Use suitable caps to protect installed raceway against entrance of moisture and dirt.
 - i. Provide a pull cord in all empty raceways.
 - j. Install expansion joint fittings where raceway crosses building expansion joints.
 - k. Install plastic conduit and tubing in strict accordance with the manufacturer's recommendations. When plastic conduit is installed, use galvanized rigid elbows for 90-degree bends.

- D. Install electrical boxes as shown on the Drawings, and as required for splices, taps, wire pulling, equipment connections and regulatory requirements.
 - a. Use large enclosure for interior pull and junction boxes larger than 12 inches in any dimension.
 - b. Locate and install electrical boxes to allow access. Provide access panels if required.
 - c. Locate and install electrical boxes to maintain headroom and to present a neat mechanical appearance.
 - d. Install pull boxes and junction boxes above accessible ceilings or in unfinished areas.

- e. Provide knockout closure for unused openings.
 - f. Align wall-mounted outlet boxes plumb and level for switches, and similar devices.
 - g. Coordinate mounting heights and locations of outlets above counters and backsplashes.
 - h. Install lighting outlets to locate luminaries as shown on the Drawings.
- E. Use recessed outlet boxes in finished areas where indicated.
- a. Secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness, and plaster/tile ring installation.
 - b. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
 - c. Locate boxes in masonry walls to require cutting corner only. Coordinate masonry cutting to achieve neat openings for boxes
 - d. Do not install boxes back-to-back in walls; provide 1-inch separation minimum.
- F. Install wireway in accordance with manufacturer's instructions.
- a. Bolt wireway to wall using two-piece hangers or steel channels fastened to the wall or on a self-supporting structure. Install level.
 - b. Mount raintight gutter in horizontal position only.
- G. Install floor boxes in accordance with manufacturer's instructions.
- a. Set boxes level and flush with finish flooring material.
 - b. Use adjustable cast floor boxes for all floor box installations.
- H. Interface outlet boxes, service fittings, floor boxes, etc. with connection of equipment.

END OF SECTION 16200

SECTION: 26 03 00 - WIRE, CABLE, AND DEVICES (600 VOLTS AND BELOW)

I. GENERAL

1. RELATED DOCUMENTS:

- A. Section 16000 – Electrical General Requirements, apply to the work specified in this Section, with additions and modifications specified herein.

2. SECTION INCLUDES:

A. WIRE AND CABLE

B. WIRING DEVICES

II. PRODUCTS

1. WIRE AND CABLE:

A. BUILDING WIRE:

- a. Feeder and Branch Circuits 10 AWG and Smaller: Copper, solid conductor, 600 volt insulation, THHN/THWN.
- b. Feeder and Branch Circuits 8 AWG and 6 AWG: Copper, stranded conductor, 600 volt insulation, THHN/THWN.
- c. Feeder and Branch Circuit larger than 6 AWG: Copper, stranded, conductor, 600 volt insulation, THW.
- d. Control Circuits: Copper, stranded conductor, 600 volt insulation, THHN/THWN.
- e. Color code all wiring to match existing systems.

B. REMOTE CONTROL SIGNAL CABLE:

- a. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600 volt insulation, rated 60 degree C, individual conductors twisted together, shielded, and covered with PVC jacket.
- b. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, rated 60 degree C, individual conductors twisted together, shielded, and covered with PVC jacket; UL listed.

2. WIRING DEVICES AND WALLPLATES:

- A. WALL SWITCHES: quiet commercial grade - operating snap switch rated 20 amperes and 120/277 volts AC, with plastic toggle handle.
- B. RECEPTACLE:
 - a. Convenience Receptacle Configuration: Type 5-20R or 5-15R commercial grade. Provide tamper resistant receptacles where required by code.
 - b. Specific Purpose Receptacle: Configuration indicated on Drawings with by code plastic face.
 - c. GFCI Receptacles: Duplex convenience receptacle with integral ground fault current interrupter.
 - d. Color: white
- D. INTERIOR COVER PLATE:
 - a. Thermoplastic white
- E. WEATHERPROOF COVER PLATE: Gasketed cast metal with hinged gasketed device covers rated raintight while in use in accordance with Article 410-57 of the National Electrical Code.

III. EXECUTION:

1. EXAMINATION AND PREPERATION:

- A. Verify that interior of building has been physically protected from weather.
- B. Verify that mechanical work which is likely to injure conductors has been completed.
- C. Completely and thoroughly swab raceway system before installing conductors.

2. INSTALLATION:

A. WIRING METHODS:

- a. Concealed Interior Locations: Building wire in raceway.
- b. Exposed Interior Locations: Building wire in raceway.
- c. Above Accessible Ceilings: Building wire in raceway.
- d. Wet or Damp Interior Locations: Building wire in raceway.
- e. Exterior Locations: Building wire in raceway.
- f. Underground Locations: Building wire in raceway.

- g. MC on AC cable may be used for fixture whips only.
 - B. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.
 - C. Neatly train and secure wiring inside boxes, equipment and panelboards.
 - D. Use UL listed wire pulling lubricant for pulling conductors in raceways.
 - E. Protect exposed cables.
 - F. Support cables above accessible ceilings to keep them from resting on ceiling tiles.
 - G. Make splices, taps, and terminations to carry full ampacity of conductors without perceptible temperature rise.
 - H. Terminate spare conductors with electrical tape.
 - I. Devices shall mount flush or as indicated on the Drawings.
 - J. Install wiring devices in accordance with manufacturer's instructions.
 - a. Install wall switches 48 inches above floor, unless noted otherwise, "OFF" position down.
 - b. Install convenience receptacles 18 inches above floor, unless noted otherwise, 2 inches above counters or splashbacks, with grounding pole on bottom.
 - c. Install GFCI receptacles at all outdoor locations and all indoor locations as required by NFPA70, and as indicated.
 - d. Install specific purpose receptacles at heights shown on Drawings.
 - K. Install wall plates flush and level.
 - a. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
 - b. Install weatherproof cover plates on all devices/boxes in wet or outdoor locations.
3. FIELD QUALITY CONTROL:
- A. Perform field inspection and testing of circuits under provisions of Section 16000.
 - a. Inspect wire and cables for physical damage and proper connection.

- b. Torque test conductor connections and terminations to manufacturer's recommended values.
- c. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

END OF SECTION 16300

SECTION 26 04 00 - POWER AND DISTRIBUTION

I. GENERAL

1. CONDITIONS AND REQUIREMENTS

- A. The General Conditions, Supplementary Conditions and Division 1, General Requirements, and Section 16000 apply.

2. SUBMITTALS

- A. Submit shop drawings and catalog cuts for complete description of all power and distribution equipment.

3. QUALITY ASSURANCE

- A. All equipment shall be UL listed.

II. PRODUCTS

1. SAFETY SWITCHES

- A. Safety switches shall be NEMA heavy duty type HD U.L. listed. All switches shall have switch blades which are fully visible in the OFF position when the door is open. Switches shall have removable arc suppressors where necessary to permit easy access to line side lugs. Lugs shall be UL listed for aluminum and/or copper cables and front removable. All current carrying parts shall be plated.
- B. Switches shall have a quick-make and quick-break operating handle and mechanism which shall be in integral part of the box, not the cover. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door in the ON or OFF position.
- C. Fusible switches shall have class R fuse provisions where required.
- D. Safety switches shall be Eaton or equal by Square D, General Electric or Siemens.

2. LIGHTING AND POWER PANELS

- A. Panels for 480/277 service shall be Square D I Line or NF series or equal. Panel for 120/208V service shall be Square D NQ series or equal. All two and three pole breakers shall be of the single handle, common trip type (no tie handles). Panel bussing shall be copper.
- B. The cabinets shall be constructed of code thickness sheet steel and galvanized. The trim shall be finished with standard prime finish coat. Hardware shall be nickel finished with

combination latch and cylinder lock. Provide door in door construction.

- C. All panels shall be fully rated (series rating is not acceptable, unless specifically noted otherwise).
- D. Circuit breakers shall be thermal magnetic molded case unless indicated otherwise on the drawings.
- E. A glass or plastic covered directory card holder shall be provided on the inside of the door which shall contain a neatly typed description of the service supplied by each breaker switch. Engraved nameplates shall be provided for distribution panels.
- F. Circuit numbers shall be mechanically secured to panel interiors. No glued-on or similar method or securing circuit breaker numbers will be accepted.
- G. All panels shall be keyed alike. Provide typed directories for all panels. Provide engraved nameplates for branch breakers in power panels rated 600 amps and above.
- H. Provide surge protection where indicated.

3. EXECUTION

3.1 INSTALLATION

- A. Install all power distribution equipment in accordance with manufacturer's instructions and applicable codes.

END OF SECTION 16400

SECTION: 26 05 00 – LIGHTING AND CONTROLS

I. GENERAL

1. RELATED DOCUMENTS:

- A. Section 16000 and 16100 – Apply to the work specified in these Sections, with additions and modifications specified herein.

II. PRODUCTS

1. LUMINAIRES:

A. LUMINAIRE SCHEDULE:

- a. Product requirements for each luminaire are specified in lighting fixture schedule on Drawings. In addition, see electrical general notes shown on the drawings.

- B. ACCESSORIES: Provide required accessories for mounting and operation of each luminaire as indicated.

2. CONTROLS

- A. See drawings for requirements.

III. EXECUTION

- 1. EXAMINATION AND PREPARATION: Examine adjacent surfaces to determine that surfaces are ready to receive work.

2. INSTALLATION:

- A. Install luminaires and accessories in accordance with manufacturer's instructions.

- a. Provide pendant accessory to mount suspended luminaires at height indicated. Use swivel hangers on sloped ceilings.
- b. Support surface mounted luminaires from ceiling structure; provide auxiliary support across ceiling structure support. Fasten to prohibit movement.
- c. Install recessed luminaires to permit removal from below. Install luminaires so that there is no light leakage around fixture trim. Support fixtures in accordance with Article 410-16 C of the National Electrical Code.
- d. Install lamps in luminaires and lampholders.

3. ADJUSTING AND CLEANING:

- A. Align luminaires and clean lenses and diffusers at completion of work.
- B. Aim adjustable luminaires and lampholders as indicated or as directed.
- C. Adjust directional arrows on exit signs to meet approval of authority having jurisdiction.
- D. Clean paint splatters, dirt and debris from installed luminaires.
- E. Relamp luminaires which have failed lamps at completion of work.
- F. Touch up luminaire and pole finish at completion of work.
- G. Adjust relays, timers, etc. to achieve specified or directed operation.

END OF SECTION 16500

SECTION 26 70 00 - FIRE ALARM SYSTEM

I. GENERAL

1. CONDITIONS AND REQUIREMENTS

- A. Division 16 Basic Electrical Materials and Methods sections apply to work of this section.
- B. The fire alarm system shall be installed by a state certified fire alarm system installation contractor.
- C. It is the intent of this specification to provide a complete and functional multiplexed addressable intelligent fire alarm system with voice activation as described herein. Included but not limited to modification to existing control panel, power supplies, standby power supply and battery, and new alarm initiating and indicating appliances and devices, monitor and supervision devices, system wiring, and accessories required to provide and install a complete and software operational system. All equipment and installation shall comply with the requirements of these specifications and the related drawings. Items specified by either shall be as if specified by both.
- D. The equipment and installation shall comply with the current provisions of the following standards:

FBC	Florida Building Code
NFPA 70	National Electrical Code
NFPA 72	National Fire Alarm Code
NFPA 101	Life Safety Code

Underwriters Laboratories, Inc. for use in fire protective signaling systems shall list the system and all components. The UL label shall be considered as evidence of compliance with this requirement. The equipment shall be listed by UL under the following standards as applicable:

UL 864/UOJZ, APOU	Control Units for Fire Protective Signaling Devices
UL 1076/APOU	Proprietary Burglar Alarm Units and Systems
UL 268	Smoke Detectors for Fire Protective Signaling Systems
UL 268A	Smoke Detectors for Duct Applications
UL 521	Heat Detectors for Fire Protective Signaling Systems
UL 464	Audible Signaling Appliances
UL 1638	Visual Signaling Appliances
UL 38	Manually Activated Signaling Boxes
UL 1971	Visual Signaling Appliances
UL 1481	Power Supplies for Fire Protective Signaling Systems
UL 1711	Amplifiers for Fire Protective Signaling Systems

Any equipment not bearing a UL label shall be removed and replaced with labeled equipment at the Contractors expense.

- E. In the case of any discrepancy between these specifications, the project drawings, and any

applicable local codes, the installed Fire Alarm System shall comply with the most stringent requirement. The system and all components shall be listed by Underwriters Laboratories for specific application as fire alarm equipment. The UL label shall be prima facie evidence of compliance with this requirement. Any equipment not bearing a UL label will be unacceptable and will be removed and replaced with labeled equipment at the Contractors expense.

2. MANUFACTURERS QUALIFICATIONS

- A. All fire alarm equipment shall be the product of one manufacturer. System appliances and devices not manufactured by the control panel manufacturer shall be products regularly distributed by the control panel manufacturer and cross listed by Underwriters Laboratories for compatibility with the system control panel. Equipment meeting all requirements of these specifications and distributed by the following manufacturer will be acceptable - Edwards Systems Technology EST 3. NO substitutions allowed.

3. INSTALLERS QUALIFICATIONS

- A. The installation and testing of all components of the system shall be performed by a Contractor holding a current certification issued by the State of Florida Department of Professional Regulation. The Contractor shall be certified as either an Alarm System Contractor Type 1 or an Unlimited Electrical Contractor in accordance with Chapter 489.505 of the Florida Statutes and the Rules of the State of Florida Department of Professional Regulation Electrical Contractors Licensing Board (Chapter 21 GG).
- B. The fire alarm contractor shall be an experienced firm regularly engaged in the layout and installation of automatic fire alarm systems. The contractor shall have successfully completed the installation, testing, and warranty of systems of the scope of the largest system on this project at least three years prior to bid, and have regularly engaged in the business of fire alarm systems contracting continuously since.
- C. The fire alarm contractor shall have been certified by the State of Florida Department of Professional Regulation to install fire alarm systems, have been NICET Level II certified, and certified by one of the above listed approved equipment manufacturers to perform installation, testing, adjustment, maintenance, and repair on the approved manufacturers equipment prior to the date of bid. The proposed fire alarm contractor shall commence no work on the project until after he furnishes evidence satisfactory to the aforementioned certifications and receives notice to proceed with the installation from the Engineer.
- D. Firms shall be factory authorized service organization and stock spare parts.

4. SUBMITTALS

- A. Shop Drawings
- B. Provide point-to-point wiring diagrams showing the points of connection and terminals used for electrical field connections in the system, including interconnections between the equipment or systems which are supervised or controlled by the system. Diagrams shall show connections from field devices to the FACP and remote fire alarm control units, initiating circuits, switches, relays and terminals.

- C. Provide plan view drawing showing device locations, terminal cabinet locations, junction boxes, other related equipment, conduit routing, wire counts, circuit identification in each conduit, and circuit layouts for all floors.
- D. Provide a complete description of the system operation on the drawings.
- E. Provide a complete list of device addresses and corresponding messages.
- F. Include annotated catalog data, in table format on the drawings, showing manufacturer's name, model, voltage, and catalog numbers for equipment and components.
- G. Provide complete riser diagrams indicating the wiring sequence of devices and their connections to the control equipment. Include a color code schedule for the wiring. Include floor plans showing the locations of devices and equipment.
- H. Battery power calculations
- I. Voltage drop calculations
- J. Submit shop drawings not smaller than 24 by 36 inches. As a minimum, the shop drawing submittal shall include the items listed above.
- K. Product data
- L. Modifications to the existing fire alarm control panel (FACP)
- M. Manual stations
- N. Batteries
- O. Battery chargers
- P. Smoke sensors
- Q. Wiring and cable
- R. Notification appliances
- S. Addressable interface devices
- T. Additional amplifiers as requested
- U. Tone generators

- V. Smoke sensor testing procedures
- AA. Submit data on proposed equipment, including but not limited to the items listed above. Include UL or FM listing cards for equipment provided.
- BB. Test reports
- CC. Furnish preliminary test results to the Architect. Include the control panel and initiating and indicating devices, a unique identifier for each device with an indication of test results, and signature of the factory-trained technician of the control panel manufacturer and equipment installer. With reports on preliminary tests, include printer information.
- DD. Operation and maintenance data
- EE. Record drawing software
- FF. Closeout submittals
- GG. Prepare and submit to the Engineer Contracting Officer six sets of detailed as-built drawings. The drawings shall include complete wiring diagrams showing connections between devices and equipment, both factory and field wired. Include a riser diagram and drawings showing the as-built location of devices and equipment. The drawings shall show the system as installed, including deviations from both the project drawings and the approved shop drawings. These drawings shall be submitted within 2 weeks after the final acceptance test of the system. At least one set of as-built (marked-up) drawings shall be provided at the time of, or prior to the final acceptance test.
- HH. Submit the installers training history for the employees involved with this contract.

5. ADDITIONAL SUBMITTAL REQUIREMENTS

- A. Battery power calculations
- B. Verify that battery capacity exceeds supervisory and alarm power requirements.
 - 1. Provide complete battery calculations for both the alarm and supervisory power requirements. Ampere hour requirements for each system component shall be submitted with the calculations.
 - 2. Provide data on each circuit to indicate that there is at least 25 percent spare capacity for notification appliances, 25 percent spare capacity for initiating devices. Annotate data for each circuit on the drawings.
 - 3. Provide data to indicate that the amplifiers have sufficient capacity to simultaneously drive fire alarm speakers at their 2 watt tap plus 50 percent spare capacity. Annotate data for each circuit on the drawings.
 - 4. Provide a detailed description of the final acceptance testing procedures

(including equipment necessary for testing smoke detectors using real smoke).

II. PRODUCTS

- A. This fire alarm system specification must be conformed to in its entirety to ensure that the installed and programmed system will function as designed, and will accommodate the future requirements and operations required by the Owner. All specified operational features shall be met without exception.

1. SYSTEM OVERVIEW AND DESCRIPTION

- A. The fire alarm system supplied under this specification shall be a microprocessor based direct wired peer to peer network system. The system shall utilize independently addressed, and microprocessor based smoke detectors, heat detectors, and modules as described in this specification.
- B. All fire alarm equipment shall be arranged and programmed to provide an integrated system for the early detection of fire, the notification of individual system building occupants, the override of the HVAC system operation, and the activation of other auxiliary systems to inhibit the spread of fire and to facilitate the safe evacuation of building occupants.
- C. The fire alarm equipment shall be installed in the locations shown on the project drawings.
- D. The fire alarm system shall be fully supervised for the detection and reporting of the derangement of any component or circuit on the system. Signaling Line Circuits shall provide the level of performance designated as Style 7 by UL and the NFPA. Indicating circuits shall provide the level of performance designated as Style Y by UL and the NFPA.
- E. The fire alarm system shall be microprocessor driven with stored program controllers. Each panel node on the network shall use a multiple microprocessor design so that the failure of a single microprocessor will not result in a local failure. Fire alarm systems that utilize only one microprocessor for system and SLC control will not be accepted.
- F. The fire alarm system shall operate from direct current having a nominal potential of 24 volts. The direct current shall be provided by a solid-state power supply connected to the building electrical system by a dedicated branch circuit in strict compliance with Articles 725 and 760 of the NEC, and these specifications.
- G. A standby power supply shall automatically supply electrical energy to the system whenever the primary power supply fails to provide the minimum voltage required for proper system operation. The standby power supply shall be an electrical battery with capacity to operate the system under maximum supervisory load for 24 Hours in Standby and then be capable of operating the system for 5 Minutes in the alarm mode. The fire alarm system shall include a charging circuit to automatically maintain the electrical charge of the battery. The fire alarm system shall include the alarm initiating and indicating appliances and devices shown on the project drawings.
- H. The Fire Alarm System shall be designed to allow the Fire Alarm Contractor to phase-

in the commissioning of the installed system to coincide with the construction schedule for the project. When phased-in commissioning of individual building systems is required, each phase shall be treated as a separate project, and the Fire Alarm Contractor shall use the system program functionality to print out and fully document the progress of each phase. No Fire Alarm functions shall be compromised if the system is phased in to service.

- I. All Control Panel Assemblies and the connected Automatic and Manual Alarm and Field Notification Appliances shall be designed and manufactured by the same company, and shall be tested and cross-listed as compatible (UOJZ) to ensure that a fully functioning system is designed and installed.
- J. Provide and install all required equipment and accessories necessary for the proper operation of the system.

2. ANALYTICAL MICROPROCESSOR BASED DETECTORS - MULTISENSOR DETECTOR OPEN AREA

- A. The Analytical Microprocessor-based Multisensor Analog detector shall use a combination of light scattering type photoelectric smoke sensor, a unipolar ionization smoke sensor and an ambient temperature sensor to detect both visible particulates and high energy particles of combustion, and changes in ambient temperature. The integral microprocessor shall employ time-based algorithms to dynamically examine values from the three sensors simultaneously and initiate an alarm based on the analysis of that data. The Multisensor detector shall be capable of adapting to ambient environmental conditions. The temperature sensor shall self-adjust to the ambient temperature of the surrounding air and input a system alarm when there is a change of 65^oF (35^oC) in ambient temperature. The detector shall continually monitor itself for any changes in sensitivity due to the environmental affects of dirt, smoke, temperature, age and humidity. The information shall be stored in the integral processor and transferred to the Analog loop controller for retrieval using a laptop PC or a Service Tool designed by the manufacturer of the detector specifically for the purpose. Separately mounted Analog Ionization, Analog Photoelectric Detectors and Analog Heat Detectors in the same location shall be an acceptable alternative if the 3 detectors are cross-zoned.
- B. In the event of a loss of communications of the smoke detector with the Electronic Loop Controller, the smoke detector will automatically revert to the Standalone Conventional operation, and Fire Alarm System functions shall not be compromised.
- C. The Multisensor smoke detector shall be rated for ceiling installation at a minimum of 30-ft (9.1m) centers and suitable for wall mount applications. The Multisensor detector shall be suitable for direct insertion into air ducts up to 3 ft (0.91m) high and 3 ft (0.91m) wide and air velocities up to 500 ft/min (0-2.54 m/sec) without requiring specific duct detector housings or sampling tubes.
- D. The alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5% smoke obscuration per foot. The integral heat sensor shall cause an alarm when it senses a change in ambient temperature of 65^oF (35^oC) or reaches it fixed temperature alarm set point of 135^oF (57^oC) nominal. The Multisensor detector shall be suitable for operation in the following environment:
 - 1. Temperature: 32 degrees F to 100 degrees F (0 degrees C to 38 degrees C)

2. Humidity: 0-93 percent RH, non condensing
3. Elevation: Up to 5000 Feet (1828 m)

3. ANALYTICAL MICROPROCESSOR BASED DETECTORS - MOUNTING BASES

- A. All Analytical Microprocessor-based Detector mounting bases shall provide a means to mount the detector to a STD Metal Box. The mounting base shall not contain any electronics, shall support all Microprocessor-based Smoke detector types detailed in this specification, and have the following minimum requirements:
 1. Removal of the respective detector shall not affect electronic loop communications with other detectors on that loop.
 2. Field wiring connections shall be made to the room side of the base, so that wiring connections can be made or disconnected by the Contractor without the need to remove the mounting base from the electrical box.
 3. The base shall be capable of supporting remote alarm annunciation.

4. MICROPROCESSOR BASED INTELLIGENT MODULES

- A. The Fire Alarm System shall incorporate microprocessor-based addressable modules for the monitoring and control of system Input and Output functions over a 2 wire electronic communications loop, using both broadcast and serial polling protocols. All modules shall display communications and alarm status.
- B. The function of each connected module shall be determined by the module type, and shall be defined in the system software through the application of a personality code. Simply changing the associated personality code may change module operation at any time.
- C. All addressing of the Microprocessor-based Addressable Modules shall be done electronically, and the electrical location of each module shall be automatically reported to the Fire Alarm Control Panel, where it may be downloaded into a PC, or printed out. The addressing of the modules shall not be dependent on their electrical location on the circuit.
- D. All Microprocessor-based Addressable Modules shall have a visual means to confirm communications with the FACP, and a visual means to confirm the alarm status of the modules.
- E. All field wiring to the Microprocessor-based Addressable Modules modules shall be supervised for opens and ground faults. All ground faults shall be location annunciated to the module of incidence.
- F. Diagnostic circuitry, and their associated indicators, with reviewable Trouble Codes, shall be integral to the Microprocessor-based Addressable Modules to assist in troubleshooting system faults.
- G. The modules shall be suitable for operation in the following environment:

1. Temperature: 32 degrees F to 120 degrees F (0 degrees C to 49 degrees C)
2. Humidity: 0-93 percent RH, non condensing

5. CONTROL RELAY MODULE

- A. Microprocessor-based Addressable Control Relay Modules shall provide one form C dry relay contact rated at 2 amps @ 24 Vdc to control external appliances or equipment processes. The control relay module shall be rated for pilot duty applications and releasing systems service. The position of the relay contact shall be confirmed by the system firmware. **Non-addressable relays will not be allowed.**

6. MICROPROCESSOR BASED ADDRESSABLE MANUAL PULL STATIONS GENERAL

- A. The Fire Alarm System shall incorporate microprocessor-based addressable Manual Pull Stations connected over a 2 wire electronic communications loop, using both broadcast and serial polling protocols. All Manual Pull Stations shall display communications and alarm status.
- B. All addressing of the Microprocessor-based Addressable Manual Pull Stations shall be done electronically, and the electrical location of each station shall be automatically reported to the Fire Alarm Control Panel, where it may be downloaded into a PC, or printed out. The addressing of the Manual Pull Station shall not be dependent on their electrical location on the circuit.
- C. All Microprocessor-based Addressable Manual Pull Stations shall have a visual means to confirm communications with the FACP, and a visual means to confirm the alarm status of the modules.
- D. All field wiring to the Microprocessor-based Addressable Manual Pull Stations shall be supervised for opens and ground faults. All ground faults shall be location annunciated to the module of incidence.
- E. Diagnostic circuitry, and their associated indicators, with reviewable Trouble Codes, shall be integral to the Microprocessor-based Addressable Manual Pull Stations to assist in troubleshooting system faults.
- F. All manual fire alarm stations shall be suitable for operation in the following environment:
 1. Temperature: 32 degrees F to 120 degrees F (0 degrees C to 49 degrees C)
 2. Humidity: 0-93 percent RH, non condensing
 3. Include ground fault to the device.

7. MICROPROCESSOR BASED ADDRESSABLE FIRE ALARM STATION

- A. The Microprocessor-based Addressable Fire Alarm Stations shall be double action fire alarm stations. Provide a key locked test feature. Finish the station in red with white PULL IN CASE OF FIRE@ lettering.

8. FIRE ALARM NOTIFICATION APPLIANCES

- A. All appliances which are supplied for the requirements of this specification shall be UL Listed for Fire Protective Service, and shall be capable of providing the Equivalent Facilitation@ which is allowed under the Americans with Disabilities Act Accessabilities Guidelines (ADA(AG)), and shall be UL 1971, and ULC S526 listed. All appliances shall be of the same manufacturer as the Fire Alarm Control Panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturers= instructions. Any appliances that do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purposes intended. Such proof shall be in the form of documentation from all manufacturers which clearly states that their equipment (as submitted) are 100% compatible with each other for the purposes intended. All strobes shall be provided with lens markings oriented for wall mounting. It shall be possible to replace the lens of any installed strobe in order to facilitate the replacement of a broken lens, or to change the orientation of the lens markings. Ceiling mounted strobes shall have lens markings with correctly oriented lettering. Removal of an installed strobe to facilitate the changing of a lens shall not be acceptable.
- B. Provide fire alarm speakers conforming to UL 464 having a minimum of three tap settings and separate terminations for each in and out connection. Tap settings shall include taps of 1/4, 1/2 and 1 watt. Speakers shall utilize the 1/2 watt tap in the system. Speakers shall have an output rating of 84 dBA at 10 feet as determined by the reverberant room test; data on peak output as determined in an anechoic chamber is not suitable. Speakers shall be capable of installation on standard 4 inch square electrical boxes. Where speakers and strobes are provided in the same location, they may be combined into a single wall mounted unit. Speakers shall be white with red letters.
- C. SELF - SYNCHRONIZED STROBES: Strobes shall be supplied by the same manufacturer as the Fire Alarm Control Equipment. In - Out screw terminals shall be provided for wiring. The Strobes shall have a white plastic faceplate marked "ALERT". They shall provide the proper candela output for the project and synchronized flash outputs.
- D. The same manufacturer as the Fire Alarm Control Equipment shall supply strobes. In - Out screw terminals shall be provided for wiring.

9. SYSTEM WIRING:

- A. RACEWAYS AND OUTLET BOXES: Shall comply with all other applicable Division 16 Specifications. Minimum raceway size for the fire alarm system shall be 3/4". The complete raceway system shall be grounded and bonded in accord with the requirements of the NEC. Outlet boxes shall be installed in the approximate locations indicated on the Drawings. It is the responsibility of the Contractor to ensure that the final locations of fire detectors and other initiating and indicating appliances and devices are in compliance with all applicable codes.
- B. CONDUCTORS AND TERMINATIONS: Shall be copper with type THHN/THWN insulation. Minimum conductor size shall be #14 AWG except that signaling line circuit (SLC) loops shall be wired with UL listed type FPL cable comprised of a jacketed and electrically non-shielded pair of conductors #18 AWG or larger. If stranded conductors are used they shall comply with Sections 760-16(c), 760-28(a), and 760-30(a) of the NEC.

- C. All circuits shall be identified using a unique conductor insulation color throughout the system for each type of circuit.
- D. Termination of conductors shall be by means of factory wiring terminals or factory pigtails.

10. CIRCUIT PROTECTORS

- A. Shall have a line-to-line response time of less than one nanosecond capable of accepting greater than 2000 amps at 28 volts. Line-to-earth response time shall be less than one nanosecond with a maximum current of 2000 amps (35 joules each line) to earth. Shield to earth current shall be 5000 amps maximum. Spark gap devices or devices incorporated in or installed within the fire alarm control panel in lieu of the specified protector are not acceptable.

11. DIGITAL COMMUNICATION

Provide a digital communicator for monitoring at a central station. Coordinate with the owner for System connections.

III. EXECUTION

The entire system shall be installed in a workmanlike manner in accordance with approved manufacturers manuals and wiring diagrams. The Contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation. All wiring shall be of the type recommended by the NEC, approved by local authorities having jurisdiction for the purpose, and shall be installed in dedicated conduit throughout. All penetration of floor slabs and fire walls shall be fire stopped in accordance with all local fire codes. In addition, all walls shall be water-proofed at conduit penetrations. End of Line Resistors: Shall be furnished as required for mounting as directed by the manufacturer. An on-site inspection of the conduit rough-in and wiring will be required per floor before Contractor is allowed to proceed to next floor. This will be coordinated with Ivanco, Inc. and the electrical engineer.

1. INSTALLATION OF CONTROL PANEL AND RELATED EQUIPMENT

- A. Installation of all Fire Alarm Control Equipment and Field Mounted Devices and Appliances shall be in strict compliance with the manufacturer's written instructions.
- B. Connection of the fire alarm system power supply (supplies) to the electrical system shall be by a dedicated branch electrical circuit. The means to disconnect this circuit shall be accessible only to authorized personnel, shall be capable of being locked in the "on" position, and shall be clearly marked "FIRE ALARM CIRCUIT CONTROL" in accord with NFPA standards.
- C. Batteries shall only be installed in the control panel enclosure when they are of the gelled-electrolyte type and where the control panel manufacturer recommends such installation.
- D. The Control Equipment shall not be installed until all field wiring to the field mounted devices and appliances have been installed and the wiring on those circuits have been checked for faults and shorts, and any faults and shorts found have been corrected.
- E. The Fire Alarm Contractor shall neatly lace all field wiring conductors in the gutter spaces of the control panels and secure the wiring away from all circuit boards and control equipment components. All field-wiring circuits shall be neatly and legibly labeled in the control panel. No wiring except homeruns from fire alarm system circuits and system power supply circuits shall be permitted in the control panel enclosure. Additionally, no

wiring splices will be permitted in the control panel enclosure.

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2. SYSTEM WIRING AND SUPERVISION

- A. Provide a Style 7 initiating and alarm circuits with electrical supervision for shorts and open circuits.
- B. Install end of line resistors as required.
- C. Power Supplies: The Control panel shall receive 120 VAC power via the existing power supply for the current fire alarm control panel, unless otherwise shown.
- D. All circuits requiring system operating power shall be 24 VDC and shall be individually fused at the control panel.
- E. Control of auxiliary services:
 - 1. Fan shut down relays. **Only addressable control relays will be allowed.**
- F. Wire system so that activation of fire alarm audible signaling devices will also activate the following:
 - 1. Interior strobe lights.
 - 2. Fan shut down circuits.
- G. System Test and Certification / Demonstration: The completely installed fire alarm system will be fully tested in compliance with Testing Procedures for Signaling Systems (ANSI/NFPA 72H). The Fire Alarm Contractor shall test:
 - 1. Every alarm initiating appliance and device for proper response and program execution.
 - 2. Every indicating appliance for proper operation and audible/visual output.
 - 3. All auxiliary control functions such as functional override of HVAC, ventilation, and pressurization controls.
- H. The Engineer shall be notified at least 10 working days prior to the scheduled testing so that he/she may be present for such testing. The testing will only be scheduled after As-Built Drawings are turned in with the Affidavit of True and Correct As-Built Drawings fully executed. Find blank affidavit at the end of this section.
 - 1. After the system has been completely tested to the satisfaction of the Engineer, and the building Owner; the Fire Alarm Contractor shall complete the Fire Alarm System Certification of Completion form published by the NFPA (Figure 1-7.2.1 in the National Fire Alarm Code). In compliance with published NFPA standards, parts 1, 2, and 4 through 10 shall be completed after the system is installed and the wiring has been checked. Part 3 shall be completed after the operational acceptance tests have been completed. The completed form signed by the qualifying agent of the Fire Alarm System Contractor shall be delivered to the Engineer with the other system documentation required by these specifications.

4. SYSTEM STARTUP

- A. A Factory Trained and Authorized Engineered Systems Distributor shall perform system Startup. A Contractor under the direction of the Factory Trained and Authorized Engineered Systems Distributor may perform certain functions of the Systems Startup Procedure.

5. INSTRUCTION OF OWNER

- A. The Fire Alarm Contractor shall schedule and execute an instruction class for the Building Owner, which details the proper operation of the installed fire alarm system. The instruction shall also cover the schedule of maintenance required by NFPA 72H and any additional maintenance recommended by the system manufacturer. This instruction shall also be separately furnished to the Local Municipal Fire Department if so requested by the Local Authority Having Jurisdiction. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation. The Fire Alarm Contractor shall provide operations manuals or any other curricula that may enhance the instruction of the Building Owners or Local Municipal Fire Department in the operation and maintenance of the system.

6. WIRING

- A. All wiring shall be installed according to NEC standards per the drawings submitted by the authorized Engineered Systems Distributor, unless otherwise noted.
- B. Wiring shall be in metallic conduit solely for the fire detection and alarm system. Wiring shall be in conformance with the recommendations and wiring diagrams provided by the Fire Alarm System manufacturer. Adhere to the zones indicated on the Drawings. Any non-metallic conduit shall be replaced with metallic conduit with not cost to the Owner.
- C. All wiring shall be tagged, numbered, color-coded and terminated on terminal blocks in the cabinets, in boxes, at equipment and at devices. Wire nuts or splices shall not be used. Each set of zone conductors shall be tagged with the zone number on each conductor at termination (each end) and in each junction or pull box in the raceway system.
- D. Mounting of fire alarm boxes shall be 48" above finished floor (Handicapped Code).
- E. Junction boxes and cabinets for the Fire Alarm System shall be painted International "FIRE RED".

7. FIELD QUALITY CONTROL

- A. The system shall be installed and fully tested under the supervision of trained manufacturer's representative. The system shall be demonstrated to perform all the functions as specified.

- B. Provide in a frame and under glass, computer generated, color-coded diagram of the building and site, indicating the zones by number. Install frame near the fire alarm control panel or the annunciator panel or at a location designated by the Owner's representative. Minimum size of the graphic shall be 11"x17".
- C. An on-site inspection of the conduit rough-in and wiring will be required per floor before Contractor is allowed to proceed to next floor. This will be coordinated with Ivanco, Inc. and the electrical engineer.

8. TESTS

- A. Upon completion of the installation, the Contractor and the manufacturer's authorized representative together shall test every alarm initiating device for proper response and zone indication, every alarm signaling device for effectiveness, and all auxiliary functions. Repeat all tests with "NORMAL" power disconnected. The Owner and designated representative shall be given the opportunity to witness these tests. An itemized test report shall be submitted to the Owner, detailing and certifying all results.

9. WARRANTIES

- A. The Contractor shall warrant the complete fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of 3 years specified herein from the date of placing the completed system in operation. The conductors shall be replaced on any loop that exhibits repeated ground faults. If the ground faults persist, each device on that loop shall be replaced. These repairs are to be considered warranty work and shall be performed at no additional cost to the Owner.
- B. The equipment manufacturer shall make available to the Owner a maintenance contract proposal to provide a minimum of 2 inspections and tests per year in compliance with NFPA-72 guidelines.
- C. The maintenance contract shall include an agreement by the manufacturer that it will provide to the Owner, verifiable evidence to substantiate its claim that damage to any part of the fire alarm system was caused by lightning. Such evidence shall include, but not limited to, proof that the surge entered the equipment either on power conductors, system ground or by communication lines. Proof that the surge was not related to switching, welding, motor starting, copy machines or equipment with silicon controlled rectifiers such as battery chargers and un-interruptible power systems.
- D. Furnish 3 bound copies of brochure including maintenance instruction, spare parts list, wiring diagram and trouble shooting check list.

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SECTION 31 00 00 - EARTHWORK

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.
- B. Project-specific Geotechnical Investigative Report.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Preparing and grading subgrades for slabs-on-grade, walks, pavements, and landscaping.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Base course for walks and pavements.
 - 4. Subsurface drainage backfill for walls and trenches.
 - 5. Excavating and backfilling trenches within building lines.
 - 6. Excavating and backfilling for underground mechanical and electrical utilities and appurtenances.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
 - 1. Division 03 Section "Concrete" for concrete encasings, cradles, and appurtenances for utility systems.

1.3 DEFINITIONS

- A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.
- B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below base, drainage fill, or topsoil materials.
- C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.
- D. Base Course: The layer placed between the subbase and surface pavement in a paving system.
- E. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by A/E or Owner. Unauthorized excavation, as well as remedial work directed by A/E or Owner, shall be at the Contractor's expense.

- F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.
- G. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

1.4 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections as well as the site-specific Geotechnical Report.
- B. Test Reports: In addition to test reports required under field quality control, submit the following:
 - 1. Laboratory analysis of each soil material proposed for fill and backfill from on-site and borrow sources.
 - 2. One optimum moisture-maximum density curve for each soil material.
 - 3. Report of actual unconfined compressive strength and/or results of bearing tests of each stratum tested.

1.5 QUALITY ASSURANCE

- A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.
- B. Testing and Inspection Service: Employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing. Should any work or materials fail to meet the requirements set forth in the plans, specifications, or Geotechnical Report, the Contractor shall pay for retesting of same.

1.6 PROJECT CONDITIONS

- A. Site Information: Data in subsurface investigation reports was used for the basis of the design and are available to the Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood the Engineer/Architect will not be responsible for interpretations or conclusions drawn there from by the Contractor. Data is made available to the Contractor.
- B. Existing Utilities: Do not interrupt existing utilities except when permitted in writing by the Owner and then only after acceptable temporary utility services have been provided.
 - 1. Provide a minimum 48-hour notice to Owner and receive written notice to proceed before interrupting any utility.
- C. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shutoff services if lines are active.

- D. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.
 - 1. Operate warning lights as recommended by authorities having jurisdiction.
 - 2. Protect structures, utilities, sidewalks, pavements, and facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.
- B. Satisfactory Soil Materials: ASTM D 2487 USCS soil classification groups GW, GP, GM, SW, SP, and P-SM; and SP-SC free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter. The fill material shall have a Modified Proctor (ASTM D1557) maximum Dry Density of at least 100 pcf, contain less than 10% fines passing the No. 200 sieve, and be Non-Plastic (NP). Materials not meeting these specifications shall not be used as structural fill.
- C. Unsatisfactory Soil Materials: ASTM D 2487 USCS soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT.
- D. Backfill and Fill Materials: Satisfactory soil materials.
- E. Base Material: Graded Aggregate Base per FDOT Specification 204, Standard Specifications for Road and Bridge Construction, latest edition.
- F. Engineered Fill: Base materials.
- G. Bedding Material: Base materials with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Filtering Material: For stormwater filter applications filter material is to be clean or washed sand with Uniformity Coefficient 1.5 – 4.0, grain size 0.2 – 0.55 mm, coefficient of permeability 2.0 to 5.0 feet per hour.
- I. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

PART 3 - EXECUTION

3.1 PREPARATION

- A. The site shall be stripped of existing structures, all organic materials, all vegetation, root systems, organic topsoil, debris, and any other deleterious material, in phases, so as to prevent and impede erosion and sedimentation. The exposed sub-grade shall be compacted to a minimum soil density of 95% of the Modified Proctor Density (ASTM D1557) with large traffic-sized non-vibratory equipment. Any areas of unsuitable or compressible material shall be removed or undercut to a stable sub-grade material or if a stable sub-grade is not encountered a minimum of three feet below the compacted sub-grade. The undercut area should then be backfilled with clean course sand fill materials and compacted to 95% of the Modified Proctor Test (ASTM D1557). The site can be filled, by placing and mechanically compacting 6-8 inch lifts with large traffic-sized non-vibratory equipment. Each lift should be compacted to a minimum soil density of 95% of the Modified Proctor Test unless specified otherwise, prior to placement of successive lifts. The top 12 inches of sub-grade should be compacted to a minimum soil density of 95% of the Modified Proctor Test, unless specified otherwise. See Geotechnical Report for additional information and recommendations.
- B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- C. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- D. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 DEWATERING

- A. Prevent surface water and subsurface or groundwater from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- C. The Contractor shall prevent the accumulation of water in the excavated areas, and shall remove by pumping or other means, any water that accumulates in the excavation. The Contractor shall prevent the accumulation of water in both structural and trench excavations and shall remove by well point system or by other means, water which accumulates in the excavation. The Contractor shall provide, install, operate and maintain pumps, well points, sumps, suction and discharge lines, and other de-watering system components necessary to convey water away from excavations.
 - 1. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rainwater and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.
 - 2. No sanitary sewer shall be used for disposal of water in either trench or structural excavations.

- D. The Contractor shall be responsible for and ensure all effluent water from the de-watering operations meets or exceeds FDEP and ACOE water quality standards prior to entering jurisdictional water bodies.

3.3 EXCAVATION

- A. Explosives: Do not use explosives.
- B. Unclassified Excavation: Excavation is unclassified and includes excavation to required subgrade elevations regardless of the character of materials and obstructions encountered.

3.4 STABILITY OF EXCAVATIONS

- A. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations. Comply with all OSHA trench safety requirements.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1.2 inches. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and for inspections. Follow the guidelines provided in the project specific Geotechnical Report.
 - 1. Excavations for Footings and Foundations: The bottom of all the perimeter footing excavations and the interior stepdown stem wall footing excavations shall undercut the width of the footing minus one foot. The width of the undercut excavation shall be the depth of the undercut plus the width of the footing. The bottom of the undercut should be mechanically compacted for a minimum depth of 12 inches to a minimum of 95% of the soil's maximum density as determined by the Modified Proctor Test (ASTM D1557). Dry soils should be wetted prior to compaction operations. Backfill for footing undercuts should be the native undercut soils at or near optimum moisture content compacted in lifts as noted in the project-specific Geotechnical Report. The compaction of the bottom of the undercut excavations, the undercut backfill, and the bottom of the interior footing excavations should be checked by the Geotechnical Engineer of Record using in place density testing at a frequency of one test per 75 linear feet of wall footing and one test in every other column footing. See Geotechnical Report for additional information and recommendations.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Method of excavation at Contractor's option subject to the approval of the Engineer.
- B. The Contractor will use caution when excavating under tree roots and under and around structures and utilities. Excavate by hand when necessary or appropriate.

- C. Excavate trenches to indicated slopes, lines, depths, and invert elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- D. Excavate trenches to uniform widths as narrow as possible and yet provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: As indicated
- E. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove stones and sharp objects to avoid point loading.
 - 1. For pipes or conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - 2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.

3.8 SHEETING, SHORING AND BRACING

- A. Provide as necessary, to hold walls of excavation, prevent damage to adjacent structures, and to protect workmen and property.
- B. Leave sheeting and shoring in place where removal might cause damage to work or as otherwise indicated on drawings.
- C. When moveable trench shield is used below spring line of pipe, it shall be lifted prior to any forward movement to avoid pipe displacement.

3.9 APPROVAL OF SUBGRADE

- A. Notify A/E and Owner of any subgrade conditions which appear unsatisfactory.
- B. When A/E and Owner determine that unforeseen unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 - 1. Unforeseen additional excavation and replacement material will be paid according to the Contract provisions for changes in Work.
- C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by A/E and Owner.

3.10 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to A/E and Owner.
 - 1. Fill unauthorized excavations under other construction as directed by A/E and Owner.
- B. Where indicated widths of utility trenches are exceeded, provide stronger pipe, or special installation procedures, as required by A/E and Owner.

3.11 STORAGE OF SOIL MATERIALS

- A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.12 BACKFILL

- A. Backfill excavations promptly, but not before completing the following:
 - 1. Acceptance of construction below finish grade including, where applicable, damproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for record documents.
 - 3. Testing, inspecting, and approval of underground utilities.
 - 4. Concrete formwork removal.
 - 5. Removal of trash and debris from excavation.

3.13 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course after bottom of trench has been excavated to proper depth and grade. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- B. Concrete backfill trenches that carry below or pass under footings and that are excavated within 18 inches of footings. Place concrete to level of bottom of footings.
- C. Place and compact initial backfill of satisfactory soil material or subbase material, free of particles larger than 1 inch, to a height of 12 inches over the utility pipe or conduit.
 - 1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
- D. Coordinate backfilling with utilities testing.

- E. Area under pavement and walks or within buildings shall be mechanically compacted to the top of the subgrade in 8-inch lifts to a minimum of 98 percent of the Modified Proctor Test.
- F. Place and compact final backfill of satisfactory soil material to final subgrade.
- G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.
- H. No trench shall be open overnight.

3.14 FILL

- A. Preparation: Remove vegetation, topsoil, debris, wet, and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills.
 - 1. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface.
- B. Place fill material in layers to required elevations for each location listed below.
 - 1. Under grass, use satisfactory excavated or borrow soil material.
 - 2. Under walks and pavements, use base material, or satisfactory excavated or borrow soil material.
 - a. Fill soils beneath walks and pavements shall be compacted to a minimum soil density of 95% of the Modified Proctor Test.
 - 3. Under steps and ramps, use base material.
 - a. Fill soils beneath walks and pavements shall be compacted to a minimum soil density of 95% of the Modified Proctor Test.
 - 4. Under footings and foundations, use engineered fill. See Geotechnical Report for additional requirements.
 - a. Buildings: Prior to placing fill soils, the top 12 inches of ground surface shall be compacted with non-vibratory traffic-sized equipment to a minimum soil density of 98% of the Modified Proctor Test. Structural fill soils should be placed in maximum 8-inch lifts compacted to a minimum soil density of 98% of the Modified Proctor Test. The top 8 inches of the building pad shall be compacted to a minimum soil density of 98% of the Modified Proctor Test.
 - b. Footings: The soil immediately beneath footings shall be compacted with a large mechanical plate tamper or jumping jack to a minimum soil density of 98% of the Modified Proctor Test. If moisture conditions are elevated and pumping is encountered, the footings shall be undercut and backfilled with compacted soils. The depth of the undercutting will depend on the width of the footings, and the conditions present at the time of construction. If these conditions are encountered, the Contractor shall contact the geotechnical engineer for the conditions to be evaluated and a recommendation made.

3.15 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air-dry satisfactory soil material that is too wet to compact to specified density. Only suitable material free from excessive moisture shall be used for fill or backfill.
 - a. Stockpile or spread and dry removed wet satisfactory soil material.

3.16 COMPACTION

- A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy non – vibratory compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.
- C. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D 1557:
 - 1. Under structures, building slabs, steps, and pavements, compact the top 12 inches below subgrade and each layer of backfill or fill material at 98 percent maximum dry density.
 - 2. Under walkways, compact the top 6 inches below subgrade and each layer of backfill or fill material at 95 percent maximum dry density.

3.17 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between existing adjacent grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 1.2 inches.
 - 2. Walks: Plus or minus 1/2 inch.
 - 3. Pavements: Plus or minus 1/2 inch.
- C. Grading Inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

- D. The finish floor elevation of concrete floor slabs on fill shall be at least 8 inches above the finish grade elevation at its highest elevation at any point around the building.

3.18 BASE COURSES

- A. Under pavements and walks, place base course material on prepared subgrades.
 - 1. Compact base courses at optimum moisture content to required grades, lines, cross sections and thickness to not less than 100 percent of ASTM D 1557 relative density.
 - 2. Shape base to required crown elevations and cross-slope grades.
 - 3. When thickness of compacted base course is 8 inches or less, place materials in a single layer.

3.19 FIELD QUALITY CONTROL

- A. Testing Agency Services: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.
 - 1. Perform field in-place density tests according to ASTM D 1556 (sand cone method), ASTM D 2167 (rubber balloon method), or ASTM D 2937 (drive cylinder method), as applicable.
 - a. Field in-place density tests may also be performed by the nuclear method according to ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, check the calibration curves furnished with the moisture gages according to ASTM D 3017.
 - b. When field in-place density tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Engineer.
 - 2. Footing Subgrade: At footing subgrades, perform at least one test of each soil stratum to verify design-bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of each subgrade with related tested strata when acceptable to A/E and Owner.
 - 3. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 5,000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 - 4. Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 100 feet or less of wall length, but no fewer than two tests along a wall face.
 - 5. Trench Backfill: In each compacted initial and final backfill layer, perform at least one field in-place density test for each 300 feet or less of trench, but no fewer than two tests.

- B. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained.

3.20 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace material to depth directed by the Engineer; reshape and recompact at optimum moisture content to the required density.
- C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.
- D. Erosion control: The Contractor shall be responsible for the prevention of erosion from the site, the control of turbidity generated on site and for maintaining graded surfaces, for the duration of the project. The Contractor shall take whatever steps necessary to prevent erosion and will be responsible for any damages that might occur to down-land properties as a result of increased run-off from the site during construction. Erosion control methods shall be in accordance with requirements of authorities having jurisdiction.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

END OF SECTION 31 00 00

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SECTION 31 11 00 - CLEARING AND GRUBBING

PART 1: GENERAL

- 1.1 General Description of Work
 - A. Clearing and grubbing on project site of trees, stumps, brush, roots, vegetation, logs, rubbish and other objectionable matter within limits described in specifications or as shown on plans.
 - B. Clearing and grubbing shall be in advance of grading and trenching operations except that in cuts over 3 feet in depth, grubbing may be done simultaneously with excavation, provided objectionable matter is removed as specified.
 - C. Disposal of all debris resulting from clearing and grubbing work.
- 1.2 Protection of Adjacent Work: Protect existing improvements, adjacent property, utilities and other facilities, and trees and plants which are not to be removed from injury or damage.
- 1.3 Protection from Erosion
 - A. Contractor shall protect all disturbed areas from erosion and sediment migration off-site.
 - B. Repair any areas damaged by erosion.
 - C. Clean erosion sediment from affected areas.
 - D. Comply with all Florida Department of Environmental Protection (FDEP) and United States Environmental Protection Agency (EPA) requirements for management of stormwater during construction activities.

PART 2: PRODUCTS

- 2.1 Materials: Provide materials required to perform work as specified.

PART 3: EXECUTION

- 3.1 Clearing
 - A. Clear all areas covered by, roads, structures and embankments within project limits unless otherwise shown in plans.
 - B. Remove all saplings, brush, downed-timber and debris unless shown or directed otherwise.

- C. Removal of trees and shrubs shall include removal of stumps and roots to the extent that no root greater than three (3) inches in diameter remains within five (5) feet of an underground structure or utility or under footings or paved areas.

3.2 Grubbing

- A. Trees, stumps, root systems, rocks and other obstructions shall be removed to the depths shown when they fall within the construction boundary. Grubbing in open areas shall include removal of stumps and three (3) inch roots to two feet below finish grade elevations.
- B. Blasting is not permitted.

3.3 Removal of Debris and Cleanup

- A. All debris resulting from stripping and demolition operations shall be removed from the Owners property at frequent intervals to prevent debris from accumulating on-site.
- B. Burning of debris on-site will not be permitted.
- C. Materials cleared and grubbed shall be the property of the Contractor and shall be his responsibility for disposal.
- D. Protection of existing trees – Contractor shall exercise extreme caution in protection of trees designated to remain. Any tree not specifically shown to be removed is designated to remain.

PART 4: MEASUREMENT AND PAYMENT

4.1 Clearing and Grubbing

- A. When not listed as a separate contract pay item, clearing and grubbing shall be considered as incidental work, and the cost thereof shall be included in such contract pay items as are provided in the proposal contract.
- B. Compensation, whether by contract pay item or incidental work will be for furnishing all materials, labor, equipment, tools and incidentals required for the work, all in accordance with the plans and these specifications.

END OF SECTION 31 11 00

SECTION 32 11 23 - GRADED AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The publications shall be the most current issue.

FLORIDA DEPARTMENT OF TRANSPORTATION (FDOT)

FDOT SPECIFICATION 204

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 117	Materials Finer than 75-Micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 136	Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	Sampling Aggregates
ASTM D 1556	Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft)

1.2 SUBMITTALS

Submit the following test reports: Materials sieve and particle size analysis

1.3 QUALITY ASSURANCE

- A. Codes and Standards: Comply with FDOT Standard Specifications, latest edition, and with local governing regulations if more stringent than herein specified.
- B. Testing and Inspection Service: Employ, at the Contractor's expense, a testing laboratory, acceptable to the Architect/Engineer, to perform testing and inspection service for quality control testing during base course placement operations. Contractor shall replace materials removed for testing purposes. Should any work of materials fail to meet the requirements set forth in the plans and specifications, Contractor shall pay for re-testing of same.

PART 2 PRODUCTS

2.1 GRADED AGGREGATE

- A. Clean, sound durable particles of crushed stone conforming to FDOT SPEC 204.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

- A. Clean underlying surface of foreign substances. Provide adequate grade and line stakes for accurate placement and completion of the base course. Surface shall be of the specified line, grade, smoothness and compaction immediately before placement of base materials.

3.2 PLACEMENT AND PROCESSING

- A. Place materials in layers of uniform thickness with an approved spreader. When the compacted thickness is specified as 6" or less, the material shall be placed in a single layer.

3.3 COMPACTING AND FINISHING

- A. Compact each layer of base course through full depth to at least 100 percent of the maximum laboratory density obtained in accordance with The Modified Proctor Test (ASTM D 1557, Method B or D). Determine in-place density in accordance with ASTM D 1556. Surface shall be smooth, free from waves, and shall not deviate by more than 1/4 inch when tested with a 10-foot straightedge. Correct nonconforming areas before applying the next course. Place earth, or other approved materials, along the exposed edges of each course to the same height and for a width of at least one foot and compact with each course.
 - 1. Layer Thickness: A. When the specified compacted thickness of the course is greater than 6 inches, construct the course in two or more layers. When the specified compacted thickness is 6 inches or less, one course construction may be used.
 - 2. Maintenance: Perform additional reworking, mixing, shaping, and compacting necessitated by damage from atmospheric conditions, traffic, or other causes. Ensure that the true grade and cross section are maintained, with no rutting or other distortion, and that the base meets all requirements at the time the subsequent base course is applied. Base shall be properly drained at all times.

3.4 FIELD QUALITY CONTROL

- A. Supply samples of coarse aggregate and binder material. Obtain approval for materials and select sources well in advance of the time when materials shall be required in the work.

1. Testing

- a. Sieve Analysis: Make sieve and particle size analysis from each sample collected during the course of the project. Tests shall include an analysis of each grade of material and an analysis of the combined material representing the blend or mixture.
- b. Smoothness Test: Perform smoothness test with a 10 foot straightedge applied parallel with and at right angles to the center line of the finished surface. Correct surface deviations in excess of 1/4 inch by loosening, adding or removing material, reshaping, watering, and compacting. When base course is constructed in more than one layer, smoothness requirements apply only to the top layer.
- c. Field Density Tests: ASTM D 1556. Perform one field density test for each 500 square yards of each layer of base course.
- d. Laboratory Density Tests: ASTM D 1557, Method B or D, for all material.
- e. Thickness Tests: Take at least one depth measurement for each 500 square yards of completed base course. Make depth measurements by test holes, at least 3 inches in diameter, through the course. Where thickness deficiency exceeds 1/2 inch, correct by scarifying, adding mixture of proper gradation, reblading, and recompacting. Where measured thickness exceeds 1/2 inch thicker than shown, it shall be considered as the indicated or specified thickness plus 1/2 inch for determining the average. Average thickness shall be the average of the depth measurements and shall not underrun the thickness shown by more than 1/4 inch.
- f. Contamination of Base Material: If at anytime, the subgrade material should become mixed with the base course materials, the Contractor shall, without additional compensation, dig out and remove the mixture, reshape and compact the subgrade and replace the materials removed with clean base material, which shall be shaped and compacted as specified.
- g. Cracks and Checks: If cracks or checks appear in the base, either before or after priming, which, in the opinion of the Engineer, would impair the structural efficiency of the base, the Contractor shall remove the cracks or checks by rescarifying, reshaping, adding base material where necessary and recompacting.

END OF SECTION 32 11 23

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SECTION 32 16 13 - CONCRETE SIDEWALKS AND CURBS & GUTTERS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. The work specified in this Section consists of the construction of Portland cement concrete curb and gutter, concrete traffic separator, valley gutter, special concrete gutter, sidewalks and any other types of concrete curb not specified in other Sections. The various items shall be constructed in accordance with these specifications and in conformity with the lines, grades, dimensions and notes shown in the plans.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Concrete: All work under this Section and any exterior concrete shall be of 4,000 PSI Concrete as specified in Section 347 of the Florida Department of Transportation Specifications for Road and Bridge Construction, latest edition, hereinafter referred to as F.D.O.T. Specifications. (Disregard mention of 2500 psi concrete in FDOT Specification).
- B. Reinforcement: Any steel reinforcement required by the plans shall conform to the requirements of Section 415 of the F.D.O.T. Specifications.
- C. Joint Materials: Joint materials for the various items shall be in accordance with Section 932 of the F.D.O.T. Specifications. Submit to Engineer for approval.
- D. Concrete Mix, Design, and Testing:

Design Mix to produce normal-weight concrete consisting of Portland cement, aggregate, water-reducing or high-range water-reducing admixture (superplasticizer), air-entraining admixture, and water to produce the flowing properties:

Compressive Strength: 4000 psi, minimum at 28 days, unless otherwise indicated. W/C ratio 0.58 maximum (non air-entrained), 0.46 maximum (air-entrained).

Slump Range: Not more than 8" after addition of HRWR admixture (superplasticizer) to verified 2"-3" slump; not more than 3" for ramps, slabs and sloping surfaces; not more than 4" for other concrete.

Air Content: 5 to 8 percent.

All sampling and testing shall be conducted by a geotechnical engineer registered in the State of Florida. Submit test results directly to the Engineer. The following test shall be taken:

28-day compressive test of concrete, minimum of 3 test cylinders per 50 cubic yards of concrete poured. If less than 50 cubic yards is poured, then a minimum of three test cylinders per day.

Air content, minimum one test for each day's pour.

Slump test, minimum three tests per 50 cubic yards of concrete poured. If less than 50 cubic yards is poured, then a minimum of three tests per day.

Contractor shall replace materials removed for testing purposes.

Should any work or material fail to meet the requirements set forth in the plans and specification, Contractor shall pay for retesting of same.

Contractor shall notify the testing laboratory 24 hours prior to work being ready for testing. Contractor shall coordinate with and assist testing laboratory.

2.2 FORMS

- A. Form Materials: Forms for this work shall be made of either wood or metal. They shall be straight, free from warp or bends and of sufficient strength, when staked, to resist the pressure of the concrete without deviation from line and grade. For all items constructed on a radius, the Contractor will be required to use flexible spring steel forms or laminated boards, unless otherwise permitted by the Engineer. Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.
- B. Depth of Forms: Forms shall have a depth equal to the plan dimensions for the depth of concrete being deposited against them.
- C. Machine Placement: Placing of these items by machine methods may be allowed with the approval of the Engineer provided that an acceptable finished product, true to line, grade and cross-section, is consistently produced.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Remove all loose material from compacted sub-grade surface immediately before placing concrete.
- B. The sub-grade shall be uniformly graded, compacted and thoroughly dampened. There shall not be any soft or muddy spots, or free-standing water on the sub-grade.

3.2 EXCAVATION

- A. Excavation shall be to the required depth, and the foundation material upon which these items are to be placed shall be compacted as specified in Section 120-9 of the F.D.O.T. Specifications.

3.3 FORM CONSTRUCTION

- A. Set forms to the required grades and lines, braced and secured. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

- B. Check complete formwork for grade and alignment to following tolerances:
- C. Top of forms not more than 1/8 inch in 10 feet.
- D. Vertical face on longitudinal axis, not more than 1/4 inch in 10 feet.
- E. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.4 REINFORCEMENT

- A. Clean reinforcement of loose rust and mill, scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- B. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runner, bolsters, spacers and hangers, as required.
- C. Place reinforcement to obtain at least the minimum coverage for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operation. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

3.5 CONCRETE PLACEMENT

- A. Do not place concrete until subgrade and forms have been checked for line and grade. Moisten sub-grade 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.
- B. Place concrete by methods that prevent segregation of mix. Consolidate concrete along face of form 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 care to prevent dislocation of reinforcing, dowels, and joint devices.
- C. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- D. Deposit and spread concrete in a continuous operation between transverse joins or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If interrupted for more than 1/2-hour, place a construction joint. Deposit concrete as nearly as practical to its final location to avoid segregation.
- E. When adjacent pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained sufficient strength to carry loads without injury.

- F. Fabricated Bar Mats: Keep mats clean and free from excessive rust, and handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.
- G. Place concrete in 2 operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay fabricated bar mats immediately in final position. Place top layer of concrete, strike off and screed.
- H. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Engineer.
- I. Curbs and Gutters: Automatic machines may be used for curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results that meet or exceed minimums specified. Machine placement must produce curbs and gutters to required cross-sections, line, grades, finish and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

3.6 JOINTS

- A. Expansion Joints: Provide pre-molded joint filler for expansion joints abutting concrete curbs, valve boxes, manholes, structures, walks and other fixed objects, unless otherwise indicated. Extend joint fillers full width and depth of joint, not less than 1/2 inch or more than 1 inch below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface. 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. Protect top edge of joint filler during concrete placement with a metal cap or other temporary material Remove protection after concrete has been placed on both sides of joint. Locate expansion joints at a distance equal to the width of the walk/slab.

For curb, locate expansion joints every 20', at end of a run, at all inlets and radius points and at other locations indicated on plans.
- B. Filler and Sealants: Sonolastic SL2 sealant or approved equal, submit specifications to Engineer for approval.
- C. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for more than 1/2 hour, except where such placements terminate at expansion joints. Located and install construction joints so as not to impair strength and appearance of the structure, as acceptable to Engineer.
- D. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs on ground and vertical surfaces.
- E. Control Joints: At intervals not greater than half the width of the walk/slab (see plans), the concrete shall be scored or saw-cut to a depth equal to one-third (1/3) the total depth of the concrete.

3.7 CONCRETE FINISHING

- A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use 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-ft. straightedge. Distribute concrete as required to remove surface irregularities, and re-float repaired areas to provide a continuous smooth finish.
- C. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2-inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.
- D. After completion of floating and when excess moisture or surface sheen has disappeared, complete troweling and finish surface as follows:
 - 1. Broom finish by drawing a fine-hair broom across concrete surface perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Engineer. Wash broom clean of excess and dried concrete as necessary during finishing operations.
 - 2. On inclined slab surfaces, provide a coarse, non-slip finish by scoring surface with a stiff-bristled broom, perpendicular to line of traffic. Wash broom clean of excess and dried concrete as necessary during finishing operations.
 - 3. Burlap finish by dragging a seamless strip of damp burlap across concrete, perpendicular to line of traffic. Repeat operation to provide a gritty texture acceptable to Engineer.
- D. 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 Engineer. Plastering will not be permitted on the face of the curb, and any rejected curb, curb and gutter or valley gutter shall be removed and replaced without additional compensation.
- E. Curb Final Finish: All exposed surfaces shall be given a finish while the concrete is still green. In general, only a brush finish will be required. For any surface areas, however, which are too rough or where other surface defects make additional finishing necessary, the Engineer may require that the curb be rubbed to a smooth surface with a soft brick or wood block, with water used liberally. Also, if necessary, further to provide a suitable surface, the Engineer may require additional rubbing, using a thin grout or mortar.

3.8 CURING

- A. General:
 - 1. The concrete shall be continuously cured for a period of at least 7 days. Curing shall be commenced after finishing has been completed and as soon as the concrete has hardened sufficiently to permit application of the curing material without marring the surface. Any curing material removed or damaged during the 7-day period shall be replaced immediately.

2. After forms are removed, the surfaces exposed shall be cured by lacing a berm of moist earth against them or by any of the methods described below, for the remainder of the 7-day curing period.
 - B. Wet Burlap Method: Burlap, as specified in 925-1, of the F.D.O.T. specifications, shall be placed over the entire exposed surface of the concrete, with sufficient extension beyond each side to insure complete coverage. Adjacent strips shall be overlapped a minimum of 150 mm (6"). The burlap shall be held securely in place such that it will be in continuous contact with the concrete at all times and no earth shall be permitted between the burlap surface at laps or between the burlap and the concrete. The burlap shall be saturated with water before being placed and shall be kept thoroughly wet throughout the curing period.
 - C. Membrane Curing Compound Method: Clear membrane curing compound or white-pigmented curing compound, as specified in 925-2 of the F.D.O.T. Specifications, shall be applied by a hand sprayer meeting the requirements of 350-3.1 0 of the F.D.O.T. Specifications, in a single-coat continuous film at a uniform coverage of at least 0.2 L/m² (1 gallon/200 S.F.). Any cracks, checks or other defects appearing in the coating shall be recoated immediately. The curing compound shall be thoroughly agitated in the drum prior to application, and during application as necessary to prevent settlement of the pigment.
 - D. Polyethylene Sheeting Method: Polyethylene sheeting, as specified in 925-3 of the F.D.O.T. Specifications, shall be placed over the entire exposed surface of the concrete, with sufficient extension beyond each side to insure complete coverage. Adjacent strips shall be overlapped a minimum of 150 mm (6"). The sheeting shall be held securely in place such that it will be in continuous contact with the concrete at all times.

3.9 BACKFILLING AND COMPACTION

- A. After the concrete has set sufficiently, but not later than 3 days after pouring, the spaces in front and back of the curb shall be refilled to the required elevation, with suitable material, which shall be placed and thoroughly compacted in layers not thicker than 150 mm (6").

3.10 SURFACE REQUIREMENTS

- A. The gutter section of curb and gutter shall be tested with a 3.048 m (10') straightedge laid parallel to the center line of the roadway, and while the concrete is still plastic. Straight edging shall be done along the edge of the gutter adjacent to the pavement or along other lines on the gutter cross section, as directed by the Engineer. Irregularities in excess of 6 mm (1/4") shall be immediately corrected.

3.11 REPAIRS AND PROTECTIONS

- A. Repair or replace broken or defective concrete, as directed by Engineer.
- B. Drill test cores where directed by Engineer 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 adhesive.

- 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 as they occur.
- D. Sweep concrete pavement and wash free of stains, dirt, and other foreign material just before final inspection.

END OF SECTION 32 16 13

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SECTION 32 12 16 - HOT – MIX ASPHALT (HMA) FOR ROADS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The publications shall be the most current issue.

FLORIDA DEPARTMENT OF TRANSPORTATION (FDOT)
FDOT RBS - Standard Specification for Road and Bridge Construction

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00, SUBMITTALS, PRODUCTS, AND SUBSTITUTIONS:

SD-05 Design Data

Job-mix formula

Submit a job-mix formula, prepared within one year of submittal, for approval by the Owner prior to preparing and placing the bituminous mixture.

1.3 QUALITY ASSURANCE

1.3.1 Required Data

Job-mix formula shall show the following:

- a. Source and proportions, percent by weight, of each ingredient of the mixture;
- b. Correct gradation, the percentages passing each size sieve listed in the specifications for the mixture to be used, for the aggregate and mineral filler from each separate source and from each different size to be used in the mixture and for the composite mixture;
- c. Amount of material passing the No. 200 sieve determined by dry sieving;
- d. Number of blows of hammer compaction per side of molded specimen;
- e. Temperature viscosity relationship of the asphalt cement;
- f. Stability, flow, percent voids in mineral aggregate, percent air voids, unit weight;
- g. Asphalt absorption by the aggregate;
- h. Effective asphalt content as percent by weight of total mix;

- i. Temperature of the mixture immediately upon completion of mixing;
- j. Asphalt viscosity grade; and

1.3.2 Charts

Plot and submit, on a grain size chart, the specified aggregate gradation band, the job-mix gradation and the job-mix tolerance band.

1.3.3 Selection of Optimum Asphalt Content

Base selection on percent of total mix and the average of values at the following points on the curves for each mix:

- a. Stability: Peak
- b. Unit Weight: Peak
- c. Percent Air Voids: Median

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the site for damage and store with a minimum of handling. Store aggregates in such a manner as to prevent segregation, contamination, or intermixing of the different aggregate sizes.

1.5 ENVIRONMENTAL CONDITIONS

Place bituminous mixture only during dry weather and on dry surfaces. Place courses only when the surface temperature of the underlying course is greater than 45 degrees F for course thicknesses greater than one inch and 55 degrees F for course thicknesses one inch or less.

1.6 CONSTRUCTION EQUIPMENT

Calibrated equipment, such as scales, batching equipment, spreaders and similar equipment, shall have been recalibrated within 12 months of commencing work.

1.6.1 Mixing Plant

Design, coordinate, and operate the mixing plant to produce a mixture within the job-mix formula tolerances and to meet the requirements of ASTM D 995, including additional plant requirements specified herein.

1.6.2 Paving Equipment

1.6.2.1 Spreading Equipment

Self-propelled electronically controlled type, unless other equipment is authorized by the Owner. Equip spreading equipment of the self-propelled electronically controlled type with hoppers, tamping or vibrating devices, distributing screws, electronically adjustable screeds, and equalizing devices. Capable of spreading hot bituminous mixtures without tearing, shoving, or gouging and to produce a finished surface of specified

grade and smoothness. Operate spreaders, when laying mixture, at variable speeds between 5 and 45 feet per minute. Design spreader with a quick and efficient steering device; a forward and reverse traveling speed; and automatic devices to adjust to grade and confine the edges of the mixture to true lines. The use of a spreader that leaves indented areas or other objectionable irregularities in the fresh laid mix during operations is prohibited.

1.6.2.2 Rolling Equipment

Self-propelled pneumatic-tired rollers supplemented by three-wheel and tandem type steel wheel rollers. The number, type and weight of rollers shall be sufficient to compact the mixture to the required density without detrimentally affecting the compacted material. Rollers shall be suitable for rolling hot-mix bituminous pavements and capable of reversing without backlash. Pneumatic-tired rollers shall be capable of being operated both forward and backward without turning on the mat, and without loosening the surface being rolled. Equip rollers with suitable devices and apparatus to keep the rolling surfaces wet and prevent adherence of bituminous mixture. Vibratory rollers especially designed for bituminous concrete compaction may be used provided rollers do not impair stability of pavement structure and underlying layers. Repair depressions in pavement surfaces resulting from use of vibratory rollers. Rollers shall be self-propelled, single or dual vibrating drums, and steel drive wheels, as applicable; equipped with variable amplitude and separate controls for energy and propulsion.

1.6.2.3 Hand Tampers

Minimum weight of 25 pounds with a tamping face of not more than 50 square inches.

1.6.2.4 Mechanical Hand Tampers

Commercial type, operated by pneumatic pressure or by internal combustion.

PART 2 PRODUCTS

2.1 AGGREGATES

Asphalt concrete pavement shall conform to FDOT RBS, SP 12.5.

2.2 VARIATIONS FROM FORMULA

Variations from the approved job-mix formula shall not exceed the following, and in no case shall the job-mix formula, with tolerances applied, fall outside the general limits for aggregate gradation and bituminous material specified herein:

<u>Aggregate</u>	<u>Tolerance (Plus or Minus)</u>
1/2 inch and larger	8 percent
3/8 and No. 4	7 percent
Nos. 8 and 16	6 percent
Nos. 30 and 50	5 percent
No. 100	4 percent
No. 200	3 percent

Asphalt Cement	0.5 percent
Temperature of Mixture as discharged	20 degrees F

2.3 SOURCE QUALITY CONTROL

Use materials for testing that are identical to materials to be provided in this project. Employ a commercial laboratory approved by the Owner to perform testing.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Mixing

Produce and transport bituminous mixture in a plant as specified in FDOT Standard Specification for Road and Bridge Construction (Most Recent addition).

3.1.2 Surface Preparation of Underlying Course

Prior to the laying of the asphalt concrete, clean underlying course of foreign or objectionable matter with power blowers or power brooms, supplemented by hand brooms and other cleaning methods where necessary. During the placement of multiple lifts of bituminous concrete, each succeeding lift of bituminous concrete shall have its underlying lift cleaned and provided with a bituminous tack coat if the time period between the placement of each lift of bituminous concrete exceeds 14 days, or the underlying bituminous concrete has become dirty.

3.1.3 Spraying of Contact Surfaces

Spray contact surfaces of previously constructed pavement with a thin coat of bituminous materials to act as an anti-stripping agent, conforming to Section 32 12 16.2, "Bituminous Tack Coat." Paint contact surfaces of structures with a thin coat of emulsion or other approved bituminous material prior to placing the bituminous mixture. Tack coat the previously placed primed coats on base courses when surface has become excessively dirty and cannot be cleaned or when primed surface has cured to the extent that it has lost all bonding effect.

3.2 PLACEMENT

3.2.1 Machine Spreading

The range of temperatures of the mixtures at the time of spreading shall be between 250 degrees F and 300 degrees F. Bituminous concrete having temperatures less than minimum spreading temperature when dumped into the spreader will be rejected. Adjust spreader and regulate speed so that the surface of the course is smooth and continuous without tears and pulling, and of such depth that, when compacted, the surface conforms with the cross section, grade, and contour indicated. Unless otherwise directed, begin the placing along the centerline of areas to be paved on a crowned section or on the high side of areas with a one-way slope. Place mixture in consecutive adjacent strips having a minimum width of 10 feet, except where the edge lanes require strips less than 10 feet to complete the area. Construct longitudinal joints and edges to true line markings. Establish lines parallel to the centerline of the area to be paved, and place string

lines coinciding with the established lines for the spreading machine to follow. Provide the number and location of the lines needed to accomplish proper grade control. When specified grade and smoothness requirements can be met for initial lane construction by use of an approved long ski-type device of not less than 30 feet in length and for subsequent lane construction by use of a short ski or shoe, in-place string lines for grade control may be omitted. Place mixture as nearly continuous as possible and adjust the speed of placing as needed to permit proper rolling.

3.2.2 Shoveling, Raking, and Tamping After Machine-Spreading

Shovelers and rakers shall follow the spreading machine. Add or remove hot mixture and rake the mixture as required to obtain a course that when completed will conform to requirements specified herein. Broadcasting or fanning of mixture over areas being compacted is prohibited. When segregation occurs in the mixture during placing, suspend spreading operation until the cause is determined and corrected. Correct irregularities in alignment left by the spreader by trimming directly behind the machine. Immediately after trimming, compact edges of the course by tamping laterally with a metal lute or by other approved methods. Distortion of the course during tamping is prohibited.

3.2.3 Hand-Spreading in Lieu of Machine-Spreading

In areas where the use of machine spreading is impractical, spread mixture by hand. The range of temperatures of the mixtures when dumped onto the area to be paved shall be between 250 and 300 degrees F. Mixtures having temperatures less than minimum spreading temperature when dumped onto the area to be paved will be rejected. Spread hot mixture with rakes in a uniformly loose layer of a thickness that, when compacted, will conform to the required grade, thickness, and smoothness. During hand spreading, place each shovelful of mixture by turning the shovel over in a manner that will prevent segregation. Do not place mixture by throwing or broadcasting from a shovel. Do not dump loads any faster than can be properly handled by the shovelers and rakers.

3.3 COMPACTION OF MIXTURE

Compact mixture by rolling. Begin rolling as soon as placement of mixture will bear rollers. Delays in rolling freshly spread mixture shall not be permitted. Start rolling longitudinally at the extreme sides of the lanes and proceed toward center of pavement, or toward high side of pavement with a one-way slope. Operate rollers so that each trip overlaps the previous adjacent strip by at least one foot. Alternate trips of the roller shall be of slightly different lengths. Conduct tests for conformity with the specified crown, grade and smoothness immediately after initial rolling. Before continuing rolling, correct variations by removing or adding materials as necessary. If required, subject course to diagonal rolling with the steel wheeled roller crossing the lines of the previous rolling while mixture is hot and in a compactible condition. Speed of the rollers shall be slow enough to avoid displacement of hot mixture. Correct displacement of mixture immediately by use of rakes and fresh mixture, or remove and replace mixture as directed. Continue rolling until roller marks are eliminated and course has a density of at least 98 percent but not more than 100 percent of that attained in a laboratory specimen of the same mixture prepared in accordance with ASTM D 1559. During rolling, moisten wheels of the rollers enough to prevent adhesion of mixture to wheels, but excessive water is prohibited. Operation of rollers shall be by competent and experienced operators. Provide sufficient rollers for each spreading machine in operation on the job and to handle plant output. In places not accessible to the rollers, compact mixture thoroughly with hot hand tampers. Skin patching of an area after compaction is prohibited. Remove mixture that becomes mixed with foreign materials or is defective and replace with fresh mixture compacted to the density specified herein. Roller shall pass over unprotected edge

of the course only when laying of course is to be discontinued for such length of time as to permit mixture to become cold.

3.4 JOINTS

Joints shall present the same texture and smoothness as other portions of the course, except permissible density at the joint may be up to 2 percent less than the specified course density. Carefully make joints between old and new pavement or within new pavements in a manner to ensure a thorough and continuous bond between old and new sections of the course. Vertical contact surfaces of previously constructed sections that are coated with dust, sand, or other objectionable material shall be painted with a thin uniform coat of emulsion or other approved bituminous material just before placing fresh mixture.

3.4.1 Transverse

Roller shall pass over unprotected end of freshly laid mixture only when laying of course is to be discontinued. Except when an approved bulkhead is used, cut back the edge of previously laid course to expose an even, vertical surface for the full thickness of the course. When required, rake fresh mixture against joints, thoroughly tamp with hot tampers, smooth with hot smoothers, and roll. Transverse joints in adjacent lanes shall be offset a minimum of 2 feet.

3.4.2 Longitudinal Joints

Space 6 inches apart. Do not allow joints to coincide with joints of existing pavement or previously placed courses. Spreader screed shall overlap previously placed lanes 2 to 3 inches and be of such height to permit compaction to produce a smooth dense joint. With a lute, push back mixture placed on the surface of previous lanes to the joint edge. Do not scatter mix. Remove and waste excess material. When edges of longitudinal joints are irregular, honeycombed, or poorly compacted, cut back unsatisfactory sections of joint and expose an even vertical surface for the full thickness of the course. When required, rake fresh mixture against joint, thoroughly tamp with hot tampers, smooth with hot smoothers, and roll while hot.

3.5 FIELD QUALITY CONTROL

3.5.1 Pavement and Mixture

Take plant samples for the determination of mix properties and field samples for thickness and density of the completed pavements. Furnish tools, labor and material for samples, and satisfactory replacement of pavement. Take samples and tests at not less than frequency specified hereinafter and at the beginning of plant operations; for each day's work as a minimum; each change in the mix or equipment; and as often as directed. Accomplish sampling in accordance with ASTM D 979.

3.5.2 Testing

3.5.2.1 Aggregates Tests

- a. Gradation: ASTM C 136.
- b. Mineral Filler Content: ASTM D 546.

- c. Abrasion: ASTM C 131 for wear (Los Angeles test). Perform one test initially prior to incorporation into the work and each time the source is changed.

3.5.2.2 Bituminous Mix Tests

Test one sample for each 500 tons, or fraction thereof, of the uncompacted mix for extraction in accordance with ASTM D 2172; perform a sieve analysis on each extraction sample in accordance with ASTM C 136 and ASTM C 117. Test one sample for each 500 tons or fraction thereof for stability and flow in accordance with ASTM D 1559. Test one sample for each material blend for index of retained strength in accordance with ASTM D 1075.

3.5.2.3 Pavement Courses

Perform the following tests:

- a. Density: One test for each 500 square yards of asphalt placed. Acceptance of in-place field density tests shall be based on the laboratory compacted density of the approved design mix as per FDOT FM 1-T166. In-place field densities shall not be less than 96% of the design mix laboratory compacted density. Engineer shall determine location of cores and tests.
- b. Thickness: Determine thickness of wearing courses from samples taken for the field density test. The maximum allowable deficiency at any point shall not be more than 1/4 inch less than the thickness for the indicated course. Average thickness of course or of combined courses shall be not less than the indicated thickness. Where a deficiency exceeds the specified tolerances, correct each such representative area or areas by removing the deficient pavement and replacing with new pavement.
- c. Smoothness: Straightedge test the compacted surface of wearing course as work progresses. Apply straightedge parallel with and at right angles to the centerline after final rolling. Unevenness of course shall not vary more 1/8 inch in 10 feet. Correct each portion of the pavement showing irregularities greater than that specified.
- d. Finished Grades: Finish grades of each course placed shall not vary from the finish elevations, profiles, and cross sections indicated by more than 1/2 inch. Finished surface of the final wearing course will be tested by the Owner. Correct deficient paved areas by removing existing work and replacing with new materials that meet the specifications. Skin patching for correcting low areas is prohibited.
- e. Finish Surface Texture of Wearing Course: Visually check final surface texture for uniformity and reasonable compactness and tightness. Final wearing course with a surface texture having undesirable irregularities such as segregation, cavities, pulls or tears, checking, excessive exposure of coarse aggregates, sand streaks, indentations, ripples, or lack of uniformity shall be removed and replaced with new materials.

3.6 PROTECTION

Do not permit vehicular traffic, including heavy equipment, on pavement until surface temperature has cooled to at least 120 degrees F. Measure surface temperature by approved surface thermometers or other satisfactory methods.

END OF SECTION 32 12 16

SECTION 32 12 16.1 - BITUMINOUS PRIME COAT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The publications shall be the most current issue.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 140	Sampling Bituminous Materials
ASTM D 2028	Cutback Asphalt (Rapid-Curing Type)

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00, SUBMITTALS, PRODUCTS, AND SUBSTITUTIONS:

SD-03 Product Data

Cutback asphalt

Submit temperature viscosity relationship.

SD-06 Test Reports

Bituminous materials

1.3 DELIVERY, STORAGE, AND HANDLING

Inspect the materials for contamination and damage. Unload and store the materials with a minimum of handling.

1.4 ENVIRONMENTAL REQUIREMENTS

Apply the prime coat only when the surface is dry or contains moisture not in excess of the amount that will permit uniform distribution and the desired penetration. Apply the prime coat only when the ambient temperature is 50 degrees F or above and when the temperature has not been below 35 degrees F for 12 hours immediately prior to application, unless otherwise directed.

1.5 SAFETY REQUIREMENTS

Perform the work in a safe manner in accordance with all applicable regulations governing the use of specified product.

1.6 CONSTRUCTION EQUIPMENT

Provide equipment dependable and adequate for the purpose intended and properly maintained in satisfactory and safe operating condition at all times. Calibrated equipment such as asphalt distributors, scales, batching equipment, spreaders and similar equipment, shall have been recalibrated by an approved calibration laboratory within 12 months prior to commencing work.

1.6.1 Bituminous Distributor

Bituminous distributor shall have pneumatic tires of such width and number that the load produced on the base surface shall not exceed 650 pounds per inch of tire width. The bituminous distributor shall be designed and equipped to distribute the bituminous material uniformly at even heat on variable widths of surface at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard, with a pressure range of 25 to 75 pounds per square inch and an allowable variation not to exceed 5 percent from any specified rate. Distributor equipment shall include a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating the materials to the proper application temperature, a thermometer for reading the temperature of the tank contents, and a hose and spray nozzle attachment for applying bituminous material to spots unavoidably missed by the distributor and to areas inaccessible to the distributor. The distributor shall be equipped to circulate and agitate the bituminous material during the heating process.

1.6.2 Heating Equipment for Storage Tanks

The equipment for heating the bituminous material shall be steam, electric, or hot oil heaters. Steam heaters shall consist of steam coils and equipment for producing steam, so designed that the steam cannot get into the material. An armored thermometer with a temperature range from 40 to 400 degrees F shall be fixed to the tank so that the temperature of the bituminous material may be determined at all times.

1.6.3 Brooms and Blowers

Brooms and blowers shall be of the power type and suitable for cleaning prepared subgrades or bases.

PART 2 PRODUCTS

2.1 BITUMINOUS MATERIAL

2.1.1 Cutback Asphalt

ASTM D 2028, Grade RC-70.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Immediately before applying the prime coat, remove loose material, dirt, clay, and other objectionable material from the surface to be primed. After the cleaning operation and prior to the application of the prime coat, examine the area to be primed. Ensure that the area is fit to receive the bituminous priming material.

3.2 APPLICATION

Immediately following the surface preparation, apply the bituminous material by means of the bituminous distributor. Apply the bituminous material at a pressure range of 25 to 75 pounds per square inch within the temperature limits specified herein, and at the rate of not less than 0.20 gallon nor more than 0.30 gallon of bituminous material per square yard. Apply the bituminous material so that uniform distribution is obtained over the entire surface to be treated. Unless the distributor is equipped to obtain satisfactory results at the junction of previous and subsequent applications, spread building paper on the surface of the applied material for a sufficient distance back from the ends of each application, so that flow from the sprays may be started and stopped on the paper, and so that all sprayers will operate at full force on the surface to be treated. Immediately after the application, remove the building paper and apply bituminous material to spots missed by the distributor.

3.2.1 Curing

Following the application of bituminous material, allow the surface to cure without being disturbed for a period of not less than 48 hours or longer, as may be necessary to attain penetration into the foundation course and evaporation of the volatiles from the bituminous material. Furnish and spread enough sand to effectively blot up and cure excess bituminous material. Maintain the primed surface until the succeeding layer of pavement is placed, by protecting the surface against damage and by repairing and repriming deficient areas.

3.2.2 Application Temperature for Cutback Asphalt

Between 100 and 150 degrees F and provide an application viscosity between 40 and 120 centistokes, kinematic, or 20 and 60 seconds, Saybolt Furol.

3.2.3 Application Temperature for Emulsified Asphalt

Between 75 and 130 degrees F.

3.3 FIELD QUALITY CONTROL

Furnish samples of bituminous materials for testing. Sample bituminous materials in accordance with ASTM D 140.

3.4 PROTECTION

Keep traffic off surfaces freshly treated with bituminous material. Provide sufficient warning signs and barricades to prevent traffic over freshly treated surfaces.

END OF SECTION 32 12 16.1

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PART 2 PRODUCTS

2.1 MATERIALS

Bituminous material for the tack coat shall be emulsified asphalt.

2.1.1 Emulsified Asphalt

ASTM D 977, Type SS-1 or ASTM D 2397, Type CSS-1. Dilute the emulsified asphalt with equal parts of water. The base asphalt used to manufacture the emulsion shall show a negative spot when tested in accordance with AASHTO T102 using standard naphtha.

2.2 CONSTRUCTION EQUIPMENT

Provide equipment dependable and adequate for the purpose intended and properly maintained in satisfactory and safe operating condition. Calibrated equipment such as asphalt distributors, scales, batching equipment, spreaders and similar equipment, shall have been recalibrated by a calibration laboratory within 12 months prior to commencing work.

2.2.1 Bituminous Distributor

The bituminous distributor shall be designed and equipped to distribute the bituminous material uniformly at even heat on variable widths of surface at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard, with a pressure range of 25 to 75 pounds per square inch and with an allowable variation not to exceed 5 percent from any specified rate. Distributor equipment shall include a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gages, volume-measuring devices, adequate heaters for heating the materials to the proper application temperature, a thermometer for reading the temperature of the tank contents, and a hose and spray nozzle attachment suitable for applying bituminous material to spots unavoidably missed by the distributor and to areas inaccessible to the distributor. The distributor shall be equipped to circulate and agitate the bituminous material during the heating process.

2.2.2 Heating Equipment for Storage Tanks

The equipment for heating the bituminous material shall be steam, electric, or hot oil heaters. Steam heaters shall consist of steam coils and equipment for producing steam, so designed that the steam cannot get into the material. An armored thermometer with a temperature range from 40 to 400 degrees F shall be fixed to the tank so that the temperature of the bituminous material may be determined at all times.

2.2.3 Brooms and Blowers

Brooms and blowers shall be of the power type suitable for cleaning the surfaces for application of the bituminous material.

PART 3 EXECUTION

3.1 PREPARATION OF SURFACE

Immediately before applying the tack coat, remove loose material, dirt, clay, and other objectionable material from the surface to be treated by a power broom or blower supplemented with hand brooms. After the cleaning operation and prior to the application of the tack coat, inspect the area to be paved to determine the fitness of the area to receive the bituminous material.

3.2 APPLICATION OF BITUMINOUS MATERIAL

Apply the tack coat when the surface to be treated is dry. Immediately following the preparation of the surface for treatment, apply the bituminous material by means of the bituminous distributor, within the limits of temperature specified herein and at a rate of not less than 0.05 gallons nor more than 0.15 gallons of diluted emulsion per square yard. Apply the bituminous material so that uniform distribution is obtained over the entire surface to be treated. Treat lightly coated areas and spots missed by the distributor with the bituminous material. Following the application of bituminous material, allow the surface to cure without being disturbed for period of time necessary to permit setting of the tack coat. Apply the bituminous tack coat only as far in advance of the placing of the overlying layer as required for that day's operation. Maintain and protect the treated surface from damage until the succeeding course of pavement is placed.

3.2.1 Application Temperature for Emulsified Asphalt

Between 75 and 130 degrees F.

3.3 FIELD SAMPLING AND TESTING

3.3.1 Sampling Bituminous Materials

Furnish samples of bituminous materials for testing. Test in accordance with ASTM D 140.

3.3.2 Bituminous Material Tests

Perform spot test for asphalt in accordance with AASHTO T102 on each shipment.

3.4 TRAFFIC CONTROLS

Keep traffic off surfaces freshly treated with bituminous material. Provide sufficient warning signs and barricades so that traffic will not travel over freshly treated surfaces.

END OF SECTION 32 12 16.2

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SECTION 32 94 50 – WELDED WIRE PLANT SUPPORT SYSTEM

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:
 - 1. Welded wire grid panels, including gate panels.
 - 2. Panel channels, posts, trim and accessories.
 - 3. Corresponding swing gate construction.
 - 4. Concrete post foundations.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog details for specified products, including list of fittings being provided with descriptions and photographs or drawings for each type.
- B. Shop Drawings: For fabrication and installation.
 - 1. Include fully dimensioned plans, elevations, and detail sections showing sizes, critical dimensions, panel layout constraints using a 2 x 2 inch modular grid, and details and locations of accessories.
 - 2. Indicate materials, methods, finishes, fittings, fasteners, anchorages, and accessories.
- C. Samples: For the following components:
 - 1. Welded wire grid panel: 6 inch square piece, with one edge of channel trim and one edge of angle trim, all as one unit.
 - 2. Finish sample: Metal chips, 2 inch square min., showing color and texture to be provided.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Minimum 5 years' experience in manufacturing and supplying welded wire panel systems of the type required for this Project.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store materials in manufacturer's packaging until ready for installation.
- B. Store panels and trim lying flat, under cover and protected from the elements. Allow panels to acclimate to room temperature (70°) for 48 hours prior to installation.
- C. Exercise care not to scratch, mark, dent, or bend metal components during delivery, storage, and installation.

1.7 PROJECT CONDITIONS

- A. Verify actual openings by field measurements before fabrication; show recorded measurements on shop drawings.
- B. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Product: Subject to compliance with requirements, provide Greenscreen products indicated on the drawings or comparable product by one of the following:
 - 1. McNichols Industrial & Architectural; Eco-Mesh.
 - 2. The Western Group; Living Screen.

2.2 COMPONENTS

- A. Panels: Prefabricated, prefinished panels constructed of rigid, three-dimensional welded wire grid, fabricated of 14 gage minimum galvanized steel wire.
 - 1. Metallic-Coated Steel Wire: Welded-wire, hot-dip galvanized in accordance with ASTM A641.
 - 2. Face Grid: Wires shall be welded at each intersection to form a 2 x 2 inch face grid on the front and back of panels,
 - 3. Trusses: Face grids shall be separated by bent wire trusses spaced at 2-inch centers and welded to front and back face grids at each truss apex.
 - 4. Thickness: 3 inches.
 - 5. Length: As determined by the manufacturer to conform to the layout indicated on the drawings.
 - 6. Height: 8 feet.
 - 7. Tolerance: 1/8 inch in length and height.
- B. Posts: Prefabricated, prefinished posts constructed of 3 inch square galvanized steel tubing.
 - 1. Type: ASTM A500, Grade B, hot-dip galvanized in accordance with ASTM A641.

2. Length: As determined by the manufacturer to meet 8-foot panel height and foundation requirements.
 3. Post Caps: Manufacturer's standard prefinished metal caps for square posts.
- C. Trim and Accessories: Manufacturer's standard fabricated and prefabricated, prefinished accessories required to provide a complete installation.
1. Trim: Fabricate from 20-gage ASTM A879 galvanized steel.
 2. Channel Trim: Thickness of panel x 1/2 inch legs.
 3. Angle Trim: 1/2 inch x 1/2 inch legs.
 4. Clips and Straps: Provide manufacturer's standard types of clips and straps suitable for mounting conditions. Fabricate from ASTM A879 galvanized steel.
 - a. Adjustable clips shall have 1/4 inch diameter stainless steel bolt, washer, and nut.
 - b. Clip spacers shall be 1/2 inch thick black polyethylene plastic.
 5. Fasteners for Mounting Clips to Fence Posts: Self drilling, self-tapping hex washer head screws, with strength of Type 410 stainless steel, and corrosion resistance of Type 304 stainless steel.
- D. Swing Gates: Fabricate frame members from 3-inch square, galvanized steel tubing, similar to fence posts.
1. Infill: Corresponding rigid, three-dimensional welded galvanized steel wire grid with edge trim, similar to fence panels.
 2. Hardware: Manufacturer's standard gate hinges, with latches permitting operation from both sides of gate. Fabricate latches with integral eye openings for padlocking.
 3. Finish: Textured polyester-urethane powder coat finish, similar to fence finish.
- E. Concrete: Normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size or dry, packaged, normal-weight concrete mix complying with ASTM C 387 mixed with potable water according to manufacturer's written instructions.

2.3 FABRICATION AND FINISH

- A. General: Welded wire panels shall be cut to size after fabrication, with all panel trim components welded and ground smooth prior to finishing.
1. Panel and Post Finish: Manufacturer's standard polyester-urethane powder coat with a minimum total dry film thickness of not less than 6 mils (0.15 mm).
 2. Texture and Color: Textured finish; color to be selected by Architect from manufacturer's standard range of colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
- B. Verify alignment, support dimensions, and tolerances are correct.
- C. Inventory components to ensure all required items are available for installation. Inspect components for damage. Remove damaged components from site and replace.

3.3 INSTALLATION

- A. General: Install welded wire panel plant support system by setting posts and fastening panels according to manufacturer's written instructions. Install panels plumb and square, centered within area designated for panels, and aligned to maintain modular grid.
 - 1. For freestanding fences and screens, span between structural supports should not exceed 8 feet for 3 inch thick panels, without thorough review of specific site conditions and mounting details.
 - 2. Avoid cutting panels in field. Where field cutting is essential, clean and dry area and apply touch-up paint to cut edges.
 - 3. Repair bent or damaged panels. If panels cannot be repaired to satisfaction of the Architect, remove from jobsite and replace with new panels.
- B. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet.
- C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 - 1. Hold posts in position during setting with concrete.
 - 2. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete. Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

3. Space posts at uniform intervals indicated on the drawings.

D. Gates: Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage.

E. Plants: Installation of plants is specified in Division 32 Section "Plants".

3.4 ADJUSTING AND CLEANING

A. Remove temporary coverings and protection of adjacent work areas. Clean installed products in accordance with manufacturer's instructions before Owner's acceptance. Do not use abrasive cleaners.

B. Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding. Lubricate hardware and other moving parts.

3.5 PROTECTION

A. Protect installed products until completion of Project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

C. Protect installed products and finished surfaces from damage during construction.

D. Replace defective or damaged components as directed by Architect.

END OF SECTION 32 94 50

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SECTION 33 11 00 – WATER DISTRIBUTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The publications shall be the most current issue.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 307	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 536	Ductile Iron Castings
ASTM C 94	Ready-Mixed Concrete
ASTM D 1785	Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2466	Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2564	Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2774	Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3139	Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM F 402	Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F 477	Elastomeric Seals (Gaskets) for Joining Plastic Pipe

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. (75 mm Through 1200 mm), for Water and Other Liquids
AWWA C111/A21.11	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

ANSI/AWWA C151/A21.51	Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C153/A21.53	Ductile-Iron Compact Fittings, 3 in. Through 24 in. (76 mm Through 610 mm) and 54 in. Through 64 in. (1,000 mm Through 1,600 mm), for Water Service
AWWA C500	Metal-Seated Gate Valves for Water Supply Service
AWWA C502	Dry-Barrel Fire Hydrants
AWWA C508	Swing-Check Valves for Waterworks Service, 2 in. (50 mm) Through 24 in. (600 mm) NPS
AWWA C509	Resilient-Seated Gate Valves for Water and Sewerage Systems
AWWA C600	Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C651	Disinfecting Water Mains
AWWA C800	Underground Service Line Valves and Fittings
AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. Through 12 in., for Water Distribution
AWWA C906	Polyethylene (PE) Pressure Pipe and Fittings, 4 in. Through 63 in., for Water Distribution
AWWA M23	PVC Pipe - Design and Installation

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC. (MSS)

MSS SP-80	Bronze Gate, Globe, Angle and Check Valves
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24	Installation of Private Fire Service Mains and Their Appurtenances
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UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-3	Installation of Polyvinyl Chloride (PVC) Pressure Pipe
UBPPA UNI-B-8	Direct Tapping of Polyvinyl Chloride (PVC) Pressure Water Pipe

UNDERWRITERS LABORATORIES INC. (UL)

UL 246	Hydrants for Fire-Protection Service
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UL 262	Gate Valves for Fire-Protection Service
UL 312	Check Valves for Fire-Protection Service
UL 789	Indicator Posts for Fire-Protection Service

1.2 DESIGN REQUIREMENTS

1.2.1 Water Distribution Mains

Provide water distribution mains indicated as 4 through 12 inch diameter pipe sizes of ductile-iron or polyvinyl chloride (PVC) plastic pipe. Also provide water main accessories, gate valves and check valves as specified and where indicated.

1.2.2 Water Service Lines

Provide water service lines indicated as less than 4-inch lines from water distribution main to building service at the point indicated. Water service lines shall be polyvinyl chloride (PVC) plastic pipe. Provide water service line appurtenances as specified and where indicated.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00, SUBMITTALS, PRODUCTS, AND SUBSTITUTIONS:

SD-03 Product Data

Piping Materials

Water distribution main piping, fittings, joints, valves, and coupling

Water service line piping, fittings, joints, valves, and coupling

Hydrants

Indicator posts

Corporation stops

Valve boxes

Water meters

Backflow preventers

Submit manufacturer's standard drawings or catalog cuts, except submit both drawings and cuts for push-on and rubber-gasketed bell-and-spigot joints. Include information concerning gaskets with submittal for joints and couplings.

SD-07 Certificates

Water distribution main piping, fittings, joints, valves, and coupling

Water service line piping, fittings, joints, valves, and coupling

Shop-applied lining and coating

Lining

Fire hydrants

Certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the intervals or frequency specified in the publication. Other tests shall have been performed within 3 years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project.

SD-08 Manufacturer's Instructions

Installation procedures for water piping

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store plastic piping, jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves and hydrants free of dirt and debris.

1.4.2 Handling

Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged. Carry, do not drag pipe to the trench. Store plastic piping, jointing materials and rubber gaskets that are not to be installed immediately, under cover out of direct sunlight.

PART 2 PRODUCTS

2.1 WATER DISTRIBUTION MAIN MATERIALS

2.1.1 Piping Materials

2.1.1.1 Ductile-Iron Piping

- a. Pipe and Fittings: Pipe, ANSI/AWWA C151/A21.51, Thickness Class 51. Fittings, AWWA C110/A21.10 or AWWA C153/A21.53; fittings with push-on joint ends conforming to the same requirements as fittings with mechanical-joint ends, except that the bell design shall be modified, as approved, for push-on joint. Fittings shall have pressure rating at least equivalent to that of the pipe. Ends of pipe and fittings shall be suitable for the specified joints. Pipe and fittings shall have cement-mortar lining, AWWA C104/A21.4, standard thickness.
- b. Joints and Jointing Material:
 - (1) Joints: Joints for pipe and fittings shall be mechanical joints.
 - (2) Mechanical Joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets, AWWA C111/A21.11.
 - (3) Flange for setscrewed flanges shall be of ductile iron, ASTM A 536, Grade 65-45-12, and conform to the applicable requirements of ASME/ANSI B16.1, Class 250. Setscrews for setscrewed flanges shall be 190,000 psi tensile strength, heat treated and zinc-coated steel. Gasket for setscrewed flanges, in accordance with applicable requirements for mechanical-joint gaskets specified in AWWA C111/A21.11. Design of setscrewed gasket shall provide for confinement and compression of gasket when joint to adjoining flange is made.

2.1.1.2 Polyvinyl Chloride (PVC) Plastic Piping

- a. Pipe and Fittings: Pipe, AWWA C900, shall be plain end or gasket bell end, Pressure Class 235 (DR 18) with cast-iron-pipe-equivalent OD. Fittings shall be gray iron or ductile iron, AWWA C110/A21.10 or AWWA C153/A21.53, and have cement-mortar lining, AWWA C104/A21.4, standard thickness. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except that bell design shall be modified, as approved, for push-on joint suitable for use with PVC plastic pipe specified in this paragraph.
- b. Joints and Jointing Material: Joints for pipe shall be push-on joints, ASTM D 3139. Joints between pipe and metal fittings, valves, and other accessories shall be push-on joints ASTM D 3139, or compression-type joints/mechanical joints, ASTM D 3139 and AWWA C111/A21.11. Provide each joint connection with an elastomeric gasket suitable for the bell or coupling with which it is to be used. Gaskets for push-on joints for pipe, ASTM F 477. Gaskets for push-on joints and compression-type joints/mechanical joints for joint connections between pipe and metal fittings, valves, and other accessories, AWWA C111/A21.11, respectively, for push-on joints and mechanical joints. Mechanically coupled joints using a sleeve-type mechanical coupling, as specified in paragraph entitled "Sleeve-Type Mechanical Couplings," may be used as an optional jointing method in lieu of push-on joints on plain-end PVC plastic pipe, subject to the limitations specified for mechanically coupled joints using a sleeve-type mechanical coupling and to the use of internal stiffeners as specified for compression-type joints in ASTM D 3139.

2.1.1.3 Polyethylene (PE) Plastic Piping

Pipe and heat-fusion fittings shall conform to AWWA C906.

2.1.2 Valves, Hydrants, and Other Water Main Accessories

2.1.2.1 Gate Valves on Buried Piping

AWWA C500, AWWA C509, or UL 262. Unless otherwise specified, valves conforming to: (1) AWWA C500 shall be non-rising stem type with double-disc gates and mechanical-joint ends or push-on joint ends as appropriate for the adjoining pipe, (2) AWWA C509 shall be non-rising stem type with mechanical-joint ends, and (3) UL 262 shall be inside-screw type with operating nut, double-disc or split-wedge type gate, designed for a hydraulic working pressure of 200 psi, and shall have mechanical-joint ends or push-on joint ends as appropriate for the pipe to which it is joined. Materials for UL 262 valves shall conform to the reference standards specified in AWWA C500. Valves shall open by counterclockwise rotation of the valve stem. Stuffing boxes shall have O-ring stem seals. Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair.

2.1.2.2 Gate Valves

AWWA C500, AWWA C509, or UL 262. Unless otherwise specified, valves conforming to: AWWA C509 shall be nonrising stem type with flanged ends and a working pressure of 200 psi. Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair.

2.1.2.3 Check Valves

Swing-check type, AWWA C508 or UL 312. Valves conforming to: (1) AWWA C508 shall have iron or steel body and cover and flanged ends, designed for a working pressure of 200 psi. Valves shall have clear port opening. Valves shall be spring-loaded.

2.1.2.4 Fire Hydrants

Dry-barrel type. Paint hydrants with at least one coat of primer and two coats of yellow enamel paint, except use red enamel paint for tops of hydrants in non-potable water systems. Stencil hydrant number and main size on the hydrant barrel using black stencil paint.

- a. Dry-Barrel Type Fire Hydrants: Dry-barrel type hydrants, AWWA C502 or UL 246, "Base Valve" design, shall have 6 inch inlet, 5 1/4 inch valve opening, one 4 1/2 inch pumper connection, and two 2 1/2 inch hose connections. Pumper connection and hose connections shall be individually valved with independent nozzle gate valves. Inlet shall have mechanical-joint end only; end shall conform to the applicable requirements as specified for the joint. Size and shape of operating nut, cap nuts, and threads on hose and pumper connections shall be as specified in AWWA C502. Hydrants indicated as "traffic type," shall have frangible sections as mentioned in AWWA C502. The traffic-type hydrant shall have special couplings joining upper and lower sections of hydrant barrel and shall be designed to have the special couplings break from a force not less than that which would be imposed by a moving vehicle; hydrant shall operate properly under normal conditions.

2.1.2.5 Indicator Posts

UL 789. Provide for gate valves where indicated.

2.1.2.6 Valve Boxes

Provide a valve box for each gate valve on buried piping, except where indicator post is shown. Valve boxes shall be of cast iron or precast concrete of a size suitable for the valve on which it is to be used and shall be adjustable. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 5 1/4 inches. Cast-iron box shall have a heavy coat of bituminous paint.

2.1.2.7 Sleeve-Type Mechanical Couplings

Couplings shall be designed to couple plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections. The coupling shall consist of one middle ring flared or beveled at each end to provide a gasket seat; two follower rings; two resilient tapered rubber gaskets; and bolts and nuts to draw the follower rings toward each other to compress the gaskets. The middle ring and the follower rings shall be true circular sections free from irregularities, flat spots, and surface defects; the design shall provide for confinement and compression of the gaskets. For ductile iron and PVC plastic pipe, the middle ring shall be of cast-iron or steel; and the follower rings shall be of malleable or ductile iron. Gaskets shall be designed for resistance to set after installation and shall meet the applicable requirements specified for gaskets for mechanical joint in AWWA C111/A21.11. Bolts shall be track-head type, ASTM A 307, Grade A, with nuts, ASTM A 563, Grade A; or round-head square-neck type bolts, ANSI B18.5.2.1M and ANSI/ASME B18.5.2.2M with hex nuts, ASME/ANSI B18.2.2. Bolts shall be 5/8 inch in diameter. Bolt holes in follower rings shall be of a shape to hold fast the necks of the bolts used. Mechanically coupled joints using a sleeve-type mechanical coupling shall not be used as an optional method of jointing except where pipeline is adequately anchored to resist tension pull across the joint.

2.1.2.8 Tracer Wire for Nonmetallic Piping

Provide bare copper or aluminum wire not less than 0.10 inch in diameter in sufficient length to be continuous over each separate run of nonmetallic pipe.

2.2 WATER SERVICE LINE MATERIALS

2.2.1 Piping Materials

2.2.1.1 Plastic Piping

Plastic pipe and fittings shall bear the seal of the National Sanitation Foundation for potable water service. Plastic pipe and fittings shall be supplied from the same manufacturer.

- a. Polyvinyl Chloride (PVC) Plastic Piping: ASTM D 1785, Schedule 40; or ASTM D 2241, with SDR as necessary to provide 150 psi minimum pressure rating. Fittings, ASTM D 2466. Pipe and fittings shall be of the same PVC plastic material and shall be one of the following pipe/fitting combinations, as marked on the pipe and fitting, respectively: PVC 1120/PVC I; PVC 1220/PVC 12; PVC 2120/PVC II; PVC 2116/PVC II. Solvent cement for jointing, ASTM D 2564.

2.2.1.2 Insulating Joints

Joints between pipe of dissimilar metals shall have a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact between adjacent sections of piping.

2.2.2 Water Service Line Appurtenances

2.2.2.1 Corporation Stops

Ground key type; bronze, ASTM B 61 or ASTM B 62; and suitable for the working pressure of the system. Ends shall be suitable for solder-joint, or flared tube compression-type joint. Threaded ends for inlet and outlet of corporation stops, AWWA C800; coupling nut for connection to flared copper tubing, ASME/ANSI B16.26.

2.2.2.2 Curb or Service Stops

Ground key, round way, inverted key type; made of bronze, ASTM B 61 or ASTM B 62; and suitable for the working pressure of the system. Ends shall be as appropriate for connection to the service piping. Arrow shall be cast into body of the curb or service stop indicating direction of flow.

2.2.2.3 Gate Valves on Buried Piping (3 Inches and Larger)

Gate valves 3 inch size and larger on buried piping AWWA C500 or UL 262 and of one manufacturer. Valves, AWWA C500, nonrising stem type with double-disc gates. Valves, UL 262, inside-screw type with operating nut, split wedge or double disc type gate, and designed for a hydraulic working pressure of 175 psi. Materials for UL 262 valves conforming to the reference standards specified in AWWA C500. Valves shall open by counterclockwise rotation of the valve stem. Stuffing boxes shall have O-ring stem seals and shall be bolted and constructed so as to permit easy removal of parts for repair.

2.2.2.4 Gate Valves on Buried Piping (Smaller Than 3 Inches)

Gate valves smaller than 3 inch size on buried Piping MSS SP-80, Class 150, solid wedge, nonrising stem. Valves shall have flanged or threaded end connections, with a union on one side of the valve.

2.2.2.5 Curb Boxes

Provide a curb box for each curb or service stop. Curb boxes shall be of cast iron of a size suitable for the stop on which it is to be used. Provide a round head. Cast the word "WATER" on the lid. Each box shall have a heavy coat of bituminous paint.

2.2.2.6 Valve Boxes

Provide a valve box for each gate valve on buried piping. Valve boxes shall be of cast iron of a size suitable for the valve on which it is to be used and shall be adjustable. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 5 1/4 inches.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES

3.1.1 General Requirements for Installation of Pipelines

These requirements shall apply to all pipeline installation except where specific exception is made in the "Special Requirements..." paragraphs.

3.1.1.1 Location of Water Lines

Terminate the work covered by this section at a point approximately 5 feet from the building, unless otherwise indicated. Do not lay water lines in the same trench with gas lines fuel lines or electric wiring.

a. Water Piping Installation Parallel With Sewer Piping

(1) Normal Conditions: Lay water piping at least 10 feet horizontally from a sewer or sewer manhole whenever possible. Measure the distance edge-to-edge.

(2) Unusual Conditions: When local conditions prevent a horizontal separation of 10 feet, the water piping may be laid closer to a sewer or sewer manhole provided that:

(a) The bottom (invert) of the water piping shall be at least 18 inches above the top (crown) of the sewer piping.

(b) Where this vertical separation cannot be obtained, the sewer piping shall be constructed of AWWA-approved water pipe and pressure tested in place without leakage prior to backfilling.

(c) The sewer manhole shall be of watertight construction and tested in place.

b. Installation of Water Piping Crossing Sewer Piping

(1) Normal Conditions: Water piping crossing above sewer piping shall be laid to provide a separation of at least 18 inches between the bottom of the water piping and the top of the sewer piping.

(2) Unusual Conditions: When local conditions prevent a vertical separation described above, use the following construction:

(a) Sewer piping passing over or under water piping shall be constructed of AWWA-approved ductile iron water piping, pressure tested in place without leakage prior to backfilling.

(b) Water piping passing under sewer piping shall, in addition, be protected by providing a vertical separation of at least 18 inches between the bottom of the sewer piping and the top of the water piping; adequate structural support for the sewer piping to prevent excessive deflection of the joints and the settling on and breaking of the water piping; and that the length, minimum 20 feet, of the water piping be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer piping.

- c. Sewer Piping or Sewer Manholes: No water piping shall pass through or come in contact with any part of a sewer manhole.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 31 00 00, "Earthwork."

3.1.1.3 Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories, and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Do not under any circumstances drop or dump pipe, fittings, valves, or any other water line material into trenches. Cut pipe accurately to length established at the site and work into place without springing or forcing. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying. Grade the pipeline in straight lines; avoid the formation of dips and low points. Support pipe at proper elevation and grade. Secure firm, uniform support. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where necessary for fastening work into place. Make proper provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been properly made. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevent installation. Depth of cover over top of pipe shall not be less than 2 1/2 feet.

3.1.1.4 Installation of Tracer Wire

Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.

3.1.1.5 Connections to Existing Water Lines

Make connections to existing water lines after approval is obtained and with a minimum interruption of service on the existing line. Make connections to existing lines under pressure in accordance with the recommended procedures of the manufacturer of the pipe being tapped, except as otherwise specified, tap concrete pipe in accordance with AWWA M9 for tapping concrete pressure pipe.

3.1.2 Special Requirements for Installation of Water Mains

3.1.2.1 Installation of Ductile-Iron Piping

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

- a. Jointing: Make mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly

and the recommendations of Appendix A to AWWA C111/A21.11. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer. Make insulating joints with the gaskets, sleeves, washers, bolts, and nuts previously specified for this type joint. Assemble insulating joints as specified for flanged joints, except that bolts with insulating sleeves shall be full size for the bolt holes. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.

- b. Pipe Anchorage: Provide concrete thrust blocks for pipe anchorage. Thrust blocks shall be in accordance with the requirements of AWWA C600 for thrust restraint, except that size and positioning of thrust blocks shall be as indicated. Use concrete, ASTM C 94, having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength. Metal harness, if required, shall be in accordance with the requirements of AWWA C600 for thrust restraint, using tie rods and clamps as shown in NFPA 24, except as otherwise indicated.

3.1.2.2 Installation of PVC Plastic Water Main Pipe

Installation of PVC Plastic Water Main Pipe and Associated Fittings: Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines"; with the requirements of UBPPA UNI-B-3 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, "Installation."

- a. Jointing: Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of UBPPA UNI-B-3 for laying the pipe and the recommendations in AWWA M23, Chapter 7, "Installation," for pipe joint assembly. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly. Make compression-type joints/mechanical joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint; assemble in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories, with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111/A21.11. Cut off spigot end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.
- b. Pipe Anchorage: Provide concrete thrust blocks for pipe anchorage. Thrust blocks shall be in accordance with the requirements of UBPPA UNI-B-3 for reaction or thrust blocking and plugging of dead ends, except that size and positioning of thrust blocks shall be as indicated. Use concrete, ASTM C 94, having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a

mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

3.1.2.3 Installation of Polyethylene (PE) Plastic Piping

PE pipes shall be installed in accordance with ASTM D 2774.

3.1.2.4 Installation of Valves and Hydrants

- a. Installation of Valves: Install gate valves, AWWA C500 and UL 262, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C500. Install gate valves, AWWA C509, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C509. Install gate valves on PVC water mains in accordance with the recommendations for appurtenance installation in AWWA M23, Chapter 7, "Installation." Install check valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation, except as otherwise indicated. Make and assemble joints to gate valves and check valves as specified for making and assembling the same type joints between pipe and fittings.
- b. Installation of Hydrants: Install hydrants in accordance with AWWA C600 for hydrant installation and as indicated. Make and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Install hydrants with the 4 1/2 inch connections facing the adjacent paved surface. If there are two paved adjacent surfaces, contact the Owner for further instructions.

3.1.3 Installation of Water Service Piping

3.1.3.1 Location

Connect water service piping to the building service where the building service has been installed. Where building service has not been installed, terminate water service lines approximately 5 feet from the building line at the point indicated; such water service lines shall be closed with plugs or caps.

3.1.3.2 Service Line Connections to Water Mains

Connect service lines 2 inch size and smaller to the main by a corporation stop and gooseneck and install a service stop below the frostline. Connect service lines to ductile-iron water mains in accordance with AWWA C600 for service taps. Connect service lines to PVC plastic water mains in accordance with UBPPA UNI-B-8 and the recommendations of AWWA M23, Chapter 9, "Service Connections."

3.1.4 Special Requirements for Installation of Water Service Piping

3.1.4.1 Installation of Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the applicable requirements of ASTM D 2774, unless otherwise specified. Handle solvent cements used to join plastic piping in accordance with ASTM F 402.

- a. Jointing: Make solvent-cemented joints for PVC plastic piping using the solvent cement previously specified for this material; assemble joints in accordance with ASTM D 2855. Make plastic pipe joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.
- b. Plastic Pipe Connections to Appurtenances: Connect plastic pipe service lines to corporation stops and gate valves in accordance with the recommendations of the plastic pipe manufacturer.

3.1.5 Disinfection

Disinfect new water piping and existing water piping affected by Contractor's operations in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 and 0.5 parts per million, or the residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit the results prior to the new water piping being placed into service. Disinfection of systems supplying nonpotable water is not required.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Owner will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with the drawings and specifications.

3.2.2 Testing Procedure

Test water mains and water service lines in accordance with the applicable specified standard, except for the special testing requirements given in paragraph entitled "Special Testing Requirements." Test ductile-iron water mains in accordance with the requirements of AWWA C600 for hydrostatic testing. The amount of leakage on ductile-iron pipelines with mechanical-joints shall not exceed the amounts given in AWWA C600; no leakage will be allowed at joints made by any other method. Test PVC plastic water mains and water service lines made with PVC plastic water main pipe in accordance with the requirements of UBPPA UNI-B-3 for pressure and leakage tests. The amount of leakage on pipelines made of PVC plastic water main pipe shall not exceed the amounts given in UBPPA UNI-B-3, except that at joints made with sleeve-type mechanical couplings, no leakage will be allowed.

3.2.3 Special Testing Requirements

For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system, except that for those portions of the system having pipe size larger than 2 inches in diameter, hydrostatic test pressure shall be not less than 200 psi. Hold this pressure for not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

END OF SECTION 33 11 00

SECTION 33 30 00 - SANITARY SEWERS

PART 1 – GENERAL

1.1 DESCRIPTION:

Outside, underground sanitary sewer system, complete, ready for operation, including all gravity flow lines, pressure (force) lines, lift station, manholes, cleanouts, frames, covers, structures, appurtenances, and connections to new building and structure, service lines, existing sanitary sewer lines, and existing sanitary structures, and all other incidentals.

1.2 RELATED WORK:

- A. Maintenance of Existing Utilities: Division 01, GENERAL REQUIREMENTS.
- B. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 00 00, EARTHWORK.
- C. Concrete Work Reinforcing, Placement and Finishing; Section 03 30 53, CAST-IN-PLACE CONCRETE.

1.3 QUALITY ASSURANCE:

- A. Products Criteria:
 - 1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
 - 2. Nameplates: Nameplate bearing manufacturer's name, or identifiable trademark, securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to Public Sanitary Sewer lines and the extension, and/or modifications to Public Utility Systems.

1.4 SUBMITTALS:

- A. Submit in accordance with Division 01, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturers' Literature and Data: Submit the following as one package:
 - 1. Pipe, Fittings, and, Appurtenances.
 - 2. Jointing Material.
 - 3. Manhole and Structure Material.
 - 4. Frames and Covers.
 - 5. Steps and Ladders.
 - 6. Gate Valves.
 - 7. Valve Boxes.

- 8. Check Valves.
- 9. Pumps
- 10. Floats
- 11. Control Panel
- 12. Flow Meter

1.5 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

- A48-94 Gray Iron Castings
- A536-84 Ductile Iron Castings
- A615-00 Deformed and Plain-Billet Steel Bars for Concrete Reinforcement
- A746-99 Ductile Iron Gravity Sewer Pipe
- C76-99 Reinforced Concrete Culvert, Storm Drain and Sewer Pipe
- C139-95 Concrete Masonry Units for Construction of Catch Basins and Manholes
- C150-99 Portland Cement
- C478-97 Precast Reinforced Concrete Manhole Sections
- C857-95 Minimum Structural Design Loading for Underground Pre-cast Concrete Utility Structures
- D698-91 Laboratory Compaction Characteristics of Soil Using Standard Effort (2,400 ft-lbf/ft³ (600 kN-m/m³))
- D2321-89 Underground Installation of Flexible Thermoplastic Sewer Pipe (Rev A)
- D2412-96 Determination of External Loading Characteristics of Plastic Pipe by Parallel Plate Loading
- D2992-96 Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Fittings
- D3034-98 Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- D3212-96 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

- D3261-97 Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
- D3350-99 Polyethylene (PE) Plastics Pipe and Fittings Materials
- F477-99..... Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- F679-00..... Poly (vinyl chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
- F714-97..... Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
- F794-99..... Poly (Vinyl Chloride)(PVC) Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
- F894-98..... Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
- F949-99..... Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings

C. American Water Works Association (AWWA):

- C105-99 Polyethylene Encasement for Ductile Iron Pipe Systems
- C110-98 Ductile-Iron and Gray-Iron Fittings, 80 mm (3 inches) Through 1200 mm (48 inches) for Water and Other Liquids
- C111-95 Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings
- C116-98 Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron Pipe and Gray Iron Fittings for Water Supply Service
- C151-96 Ductile-Iron Pipe, Centrifugally Cast In Metal Molds or Sand-Lined Molds, for Water or other Liquids
- C153-94 Ductile Iron Compact Fittings, 76 mm Through 610 mm (3 Inches Through 24 Inches) and 1,400 mm Through 1,600 mm (54 Inches Through 64 Inches)
- C508..... Swing Check Valves for Waterworks, 2 inches (50 mm) Through 24 inches (600 mm)
- C509-94 Resilient Seated Gate Valves for Water and Sewerage Systems
- C512-99 Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
- C550-90 Protective Epoxy Interior Coatings for Valves and Hydrants

- C600-99 Installation for Ductile-Iron Water Mains and Their Appurtenances
- C605-94 Underground Installation of Polyvinyl (PVC) Pressure Pipe and Fittings for Water
- C900-97 Polyvinyl Chloride (PVC) Pressure Pipe, 100 mm (4 inches) Through 300 mm (12 inches) for Water Distribution
- C905-97 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 350 mm Through 1,200 mm (14 Inches Through 48 Inches), for Water Transmission and Distribution
- C906-99 Polyethylene (PE) Pressure Pipes and Fittings, 100 mm Through 1575 mm (4 Inches Through 63 Inches), for Water Distribution

D. American Association of State Highway and Transportation Officials (AASHTO):

- M198B-98 Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets

E. Uni-Bell PVC Pipe Association:

- Uni-B-6-98 Recommended Practice Low-Pressure Air Testing of Installed Sewer Pipe

PART 2 - PRODUCTS

2.1 PIPING:

A. Gravity Flow Lines (Pipe and Fittings):

1. Polyvinyl Chloride (PVC):

- a. Pipe and Fittings, 100 to 375 mm (4 to 15 inches) in diameter, shall conform to ASTM D3034, Type PSM, SDR 35. Pipe and fittings shall have elastomeric gasket joints providing a watertight seal when tested in accordance with ASTM D 3212. Gaskets shall conform to ASTM F 477. Solvent welded joints shall not be permitted.

B. Pressure (Force) Lines (Pipe and Fittings):

- 1. All pipe and fittings used in the construction of force mains shall be rated for a minimum of 1035 kPa (150 psi).
- 2. Polyvinyl Chloride (PVC): PVC pipe 100 mm to 300 mm (4 to 12 inches) shall conform to AWWA C900, Class 150 (DR 18. Fittings for PVC pipe shall be ductile iron.

2.2 JOINTING MATERIAL:

A. Gravity Flow Lines:

- 1. Ductile Iron Pipe: Push-on or mechanical joints, AWWA C111, AWWA C110. Flange joints shall comply with AWWA C115. Flange joints shall only be used in vaults or above-grade.

2. Polyvinyl Chloride (PVC) Pipe (Gravity Use): Joints, ASTM D3212. Elastomeric gasket, ASTM F477.
3. High-Density Polyethylene (HDPE) pipe and fitting joints, ASTM E-3212, elastomeric gaskets, ASTM F477.

B. Pressure (Force) Main:

1. All joints indicated on the drawings as being “restrained” shall be fully restrained and capable of restraining 50 percent above all loads acting on the joint, but not less than 1035 kPa (150 psi). Thrust blocks shall not be permitted.
2. Polyvinyl Chloride (PVC) Pipe (Pressure Use):
 - a. Push-on joints shall conform to AWWA C900, C905.
 - b. Push-on gaskets for pipe, ASTM F477.
 - c. Restrained joints shall comply with one of the following:
 - 1) Joints to mechanical ductile iron fittings shall comply with the requirements for ductile iron pipe, except the mechanical joint restraint gland shall be specifically designed for use with PVC pipe.
 - 2) Push-on bell and spigot joints shall be retained with retaining rings and thrust rods. The rings shall be ductile iron conforming to ASTM A536. The rings shall be split style with serrated inside face which grips the pipe when the halves of the ring is assembled together. The ring shall not bear directly on the back of the bell. The rods shall be of adequate size and number to resist all axial movement of the joint.

2.3 MANHOLES :

- A. Manholes shall be constructed of precast concrete segmental blocks, precast reinforced concrete rings, precast reinforced sections, or cast-in-place concrete. The manholes and vaults shall be in accordance with State Department of Transportation or State Roads Commission standard details, and the following:
1. Precast Concrete Segmental Blocks: Blocks shall conform to ASTM C139 and shall not be less than 150 mm (6 inches) thick for manholes to a depth of 3.6m (12 feet); not less than 200 mm (8 inches) thick for manholes deeper than 3.6m (12 feet) deep. Blocks shall be not less than 200 mm (8 inches) in length. Blocks shall be shaped so that joints seal and bond effectively with cement mortar. Parge structure interior and exterior with 15 mm (1/2 inch) of cement mortar applied with a trowel and finished to an even glazed surface.
 2. Precast Reinforced Concrete Rings: Rings or sections shall have an inside diameter as indicated on the drawings, and shall be not less than 1200 mm (48 inches) in diameter. Wall thickness shall conform to requirements of ASTM C76, except that lengths of the sections may be shorter as conditions require. Tops shall conform to ASTM C478. Top section shall be eccentric cone type. Steps on inside wall shall be in the same plane from bottom of structure to manhole cover.

3. Precast Reinforced Concrete Manhole Risers and Tops: Design, material and installation shall conform to requirements of ASTM C478. Top sections shall be eccentric. Steps on inside wall shall be in the same plane from bottom of structure to manhole cover.
4. Flat top manhole tops shall be reinforced concrete as detailed on the drawings.
5. Vaults: Reinforced concrete, as indicated on the plans, or precast reinforced concrete. Concrete for precast sections shall have a minimum compressive strength of 35 MPa (5,000 psi) at 28 days, ASTM A615, Grade 60 reinforcing steel, rated for AASHTO HS20-44 loading with 30 percent impact, and conform to ASTM C-857.
6. Mortar:
 - a. Precast Concrete Segmental Block Structures: By volume, 1 part of Portland cement, 1/4 part lime hydrate, and 3 parts sand.
 - b. Precast Reinforced Concrete Ring and Riser Structures: By volume, 1 part of Portland cement and 2 parts sand. Water in mixture shall produce a stiff, workable mortar, but shall not exceed 21 L (5-1/2 gallons) per sack of cement.
7. Flexible sealing compound shall be packaged in extruded preformed shape, sized to completely fill the joint between precast sections, and form permanently flexible watertight seal. The sealing compound shall be non-shrink and meet AASHTO M-198B.
8. Frames and covers shall be gray cast iron conforming to ASTM A48. The frame and cover shall be rated for HS20-44 loading, have a studded pattern on the cover, and the words "sanitary sewer". The studs and the lettering shall be raised 8 mm (5/16 inch). The cover shall be a minimum of 600 mm (24 inches) in diameter and shall have four 19 mm (3/4 inch) vent holes and two lifting slots. The bearing surface of the frame and cover shall be machine finished. The cover shall fit firmly on the frame without movement when subject to traffic.
9. Manhole steps shall be polypropylene plastic coated on a No. 4 deformed rebar conforming to ASTM C478, Polypropylene shall conform to ASTM D4101. Steps shall be a minimum of 250 mm (10 inches) wide and project a minimum of 125 mm (5 inches) away from the wall. The top surface of the step shall have a studded non-slip surface. Steps shall be placed at 300 mm (12 inch) centers.
10. Ladders, brackets and hardware shall be constructed of welded aluminum, rails shall be 10 mm (3/8 inch) by 63 mm (2-1/2 inches) spaced a minimum of 400 mm (16 inches) apart. Rungs shall be 35 mm (1-3/8 inches) in diameter and have a non-slip surface. Standoffs shall offset the ladder 180 mm (7 inches) from the wall. The ladder assembly shall be rated for a minimum of 2200 N (500 pounds).

2.4 CONCRETE:

Concrete shall have a minimum compressive strength of 20 MPa (4000 psi) at 28 days. The cement shall be Type III conforming to ASTM C150. Concrete shall conform with the provisions of Division 3 of these specifications.

2.5 REINFORCING STEEL:

Reinforcing steel shall be deformed bars, ASTM A-615, Grade 40 unless otherwise noted.

2.6 GATE VALVES:

- A. AWWA C509, resilient seated gate valves rated for 850 kPa (125 psi) WSP. Asbestos packing is prohibited. The interior and exterior of the valve shall be epoxy coated for AWWA C550.
- B. Operation:
 - 1. Shall turn counterclockwise to open.
 - 2. Underground: 50 mm (2 inch) nut for socket wrench operation.
 - 3. Above Ground and In Pits: Handwheels.
- C. Joints: End of valve shall accommodate, or be adapted to, pipe furnished.

2.7 VALVE BOXES:

- A. Cast iron extension box with screw or slide-type adjustment and flared base. Minimum thickness of metal shall be 5 mm (3/16 inch). Box shall be of such length as will be adapted, without full extension, to depth of cover required over pipe at valve location.
- B. Cast the word "SEWER" on the cover.
- C. Provide 2 "T" handle socket wrenches, of 16 mm (5/8 inch) round stock long enough to extend 600 mm (2 feet) above top of deepest valve box.

2.8 CHECK VALVES

Check valves shall be swing-check valves conforming to AWWA C508. The interior and exterior of the valve shall be epoxy coated per AWWA C550. The check valve shall be rated for minimum of 850 kPa (125 psi) working pressure.

2.9 CLEANOUT FRAMES AND COVERS:

Frames and covers shall be gray iron casting conforming to ASTM C48. The frame and cover shall be rated for HS20-44 wheel loading, have a studded pattern on its cover, vent holes, and lifting slots. The cover shall fit firmly on the frame without movement when subject to vehicular traffic. The word "SEWER" shall be cast on the cover.

2.10 WARNING TAPE:

Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape detectable type, green with black letters and imprinted with "CAUTION BURIED SEWER LINE BELOW".

PART 3 - EXECUTION

3.1 BUILDING SERVICE LINES:

- A. Install sanitary sewer service lines to point of connection within approximately 1500 mm (5 feet) outside of buildings where service is required and make connections. Coordinate the invert and location of the service line with the Contractor installing the building lines.

- B. Connections of service line to building piping shall be made after the new sanitary sewer system has been constructed, tested, and accepted for operation by the Resident Engineer. The Contractor shall install all temporary caps or plugs required for testing.
- C. When building services have not been installed at the time when the sanitary sewer system is complete, provide temporary plugs or caps at the ends of all service lines. Mark the location and depth of the service lines with continuous warning tape placed 300 mm (12 inches) above service lines.

3.2 REGRADING:

- A. Raise or lower existing manholes and structures frames and covers, cleanout frames and covers and valve boxes in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Adjust the elevation of the cleanout pipe riser, and reinstall the cap or plug. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.
- B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.
- C. The Contractor shall comply with all OSHA confined space requirements when working within existing structures.

3.3 CONNECTIONS TO EXISTING MANHOLES:

- A. Comply with all rules and regulations of the local Utility System.
- B. The connection to the existing utility shall comply with the standard details and specifications of the public utility company, except as specifically modified on the plans and specifications.

3.4 PIPE SEPARATION:

- A. Horizontal Separation - Water Mains and Sewers:
 - 1. Existing and proposed water mains shall be at least 3 meters (10 feet) horizontally from any proposed gravity flow and pressure (force main) sanitary sewer or sewer service connection.
 - 2. Gravity flow mains and pressure (force) mains may be located closer than 3 meters (10 feet) but not closer than 1.8 m (6 feet) to a water main when:
 - a. Local conditions prevent a lateral separation of ten feet; and
 - b. The water main invert is at least 450 mm (18 inches) above the crown of the gravity sewer or 600 mm (24 inches) above the crown of the pressure (force) main; and
 - c. The water main is in a separate trench separated by undisturbed earth.
 - 3. When it is impossible to meet (1) or (2) above, both the water main and sanitary sewer main shall be constructed of push-on or mechanical joint ductile iron pipe. The pipe for the sanitary sewer main shall comply with the specifications for pressure (force) mains, and the water main material shall

comply with Section 33 11 00, Water Distribution. The sewer shall be pressure tested as specified for pressure (force) mains before backfilling.

B. Vertical Separation - Water Mains and Sewers at Crossings:

1. Water mains shall be separated from sewer mains so that the invert of the water main is a minimum of 600 mm (24 inches) above the crown of gravity flow sewer or 1200 mm (48 inches) above the crown of pressure (force) mains. The vertical separation shall be maintained within 3 meters (10 feet) horizontally of the sewer and water crossing. When these vertical separations are met, no additional protection is required.
2. In no case shall pressure (force) sanitary main cross above, or within 600 mm (24 inches) of water lines.
3. When it is impossible to meet (1) above, the gravity flow sewer may be installed 450 mm (18 inches) above or 300 mm (12 inches) below the water main, provided that both the water main and sewer shall be constructed of push-on or mechanical ductile pipe. Pressure (Force) sewers may be installed 600 mm (24 inches) below the water line provided both the water line and sewer line are constructed of ductile iron pipe. The pipe for the sewer shall conform to the requirements for pressure sewers specified herein. Piping for the water main shall conform to Section 33 11 00, WATER DISTRIBUTION.
4. The required vertical separation between the sewer and the water main shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer line is at least 3 meters (10 feet).

3.5 GENERAL PIPING INSTALLATION:

- A. Lay pipes true to line and grade. Gravity flow sewer shall be laid with bells facing upgrade. Pressure (force) mains shall have the bells facing the direction of flow.
- B. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
- C. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
- D. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.
- E. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.
- F. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
- G. Do not lay sewer pipe in same trench with another pipe or other utility. Sanitary sewers shall cross at least 600 mm (2 feet) below water lines.

- H. Do not walk on pipe in trenches until covered by layers of shading to a depth of 300 mm (12 inches) over the crown of the pipe.
- I. Warning tape shall be continuously placed 300 mm (12 inches) above sewer pipe
- J. Install gravity sewer line in accordance with the provisions of these specifications and the following standards:
 - 1. Polyvinyl Chloride (PVC) Piping: ASTM D2321.
- K. Gravity Flow Lines with Secondary Containment:
 - 1. Install per manufacturer's recommendations. Install all pipe centering devices to maintain an interstitial space below the invert of the carrier pipe. Both the carrier and containment pipe shall be tested for leaks.
- L. Installation of Pressure (Force) Mains:
 - 1. Sections of piping listed on the drawings shall be fully restrained using approved joint restraint devices. Joint restraint devices shall be installed in accordance with the manufacturer's recommendations. For devices with twist of nuts, the twist of nuts shall be placed on top of the fitting for the Engineer's inspection. The Contractor shall torque test all bolts, set screws, identified by the Resident Engineer.
 - 2. Thrust blocks shall not be permitted.
 - 3. Install pressure (force) mains in accordance with the provisions of these specifications and the following standards:
 - a. Polyvinyl Chloride (PVC) Piping: AWWA C605.

3.6 MANHOLES:

A. General:

- 1. Circular Structures:
 - a. Precast concrete segmental blocks shall lay true and plumb. All horizontal and vertical joints shall be completely filled with mortar. Parge interior and exterior of structure with 15 mm (1/2 inch) or cement mortar applied with a trowel and finished to an even glazed surface.
 - b. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top, shall be sealed with a preform flexible gasket material specifically manufactured for this type of application. Adjust the length of the rings so that the eccentric conical top section will be at the required elevation. Cutting the conical top section is not acceptable.
 - c. Precast reinforced concrete manhole risers and tops. Install as specified for precast reinforced concrete rings.
- 2. Rectangular Structures:
 - a. Reinforced concrete structures shall be installed in accordance with Division 3.

- b. Precast concrete structures shall be placed on a 200 mm (8 inch) reinforced concrete pad, or be provided with a precast concrete base section. Structures provided with a base section shall be set on 200 mm (8 inches) thick aggregate base course compacted to a minimum of 95 percent of the maximum density as determined by ASTM D 698. Set precast section true and plumb. Seal all joints with pre-form flexible gasket material.
3. Do not build structures when air temperature is 0 degrees C (32 degrees F), or below.
4. Invert channels shall be smooth and semicircular in shape conforming to inside of adjacent sewer section. Make changes in direction of flow with a smooth curve of as large a radius as size of structure will permit. Make changes in size and grade of channels gradually and evenly. Construct invert channels by one of the listed methods:
 - a. Forming directly in concrete base of structure.
 - b. Building up with brick and mortar.
5. Floor of structure outside the channels shall be smooth and slope toward channels not less than 1:12 (1-inch per foot) nor more than 1:6 (2 inches per foot). Bottom slab and benches shall be concrete.
6. The wall that support access rungs or ladder shall be 90 degrees vertical from the floor of structure to manhole cover.
7. Install steps and ladders per the manufacturer's recommendations. Steps and ladders shall not move or flex when used. All loose steps and ladders shall be replaced by the Contractor.
8. Install manhole frames and covers on a mortar bed, and flush with the finish pavement. Frames and covers shall not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. In unpaved areas, the rim elevation shall be 50 mm (2 inches) above the adjacent finish grade. Install a 200 mm (8 inches) thick, by 300 mm (12 inches) concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

3.7 SEWER AND MANHOLE SUPPORTS, CONCRETE CRADLES:

Reinforced concrete as detailed on the drawings. The concrete shall not restrict access for future maintenance of the joints within the piping system.

3.8 CLEANOUTS:

- A. 150 millimeters (6 inches) in diameter and consisting of a ductile iron 45-degree fitting on end of run, or combination Y fitting and 1/8 bend in the run with ductile iron pipe extension, water-tight plug or cap and cast frame and cover flush with finished grade. Center-set cleanouts, located in unpaved areas, in a 300 by 300 by 150 mm (12 by 12 by 6 inch) thick concrete slab set flush with adjacent finished grade. Where cleanout is in force main, provide a blind flange top connection. The center of the flange shall be equipped with a 50 mm (2 inches) base valve to allow the pressure in the line to be relieved prior to removal of the blind flange. Frames and covers for pressure (force) mains shall be 600 mm (24 inches) in diameter.

- B. The top of the cleanout assembly shall be 50 mm (2 inches) below the bottom of the cover to prevent loads being transferred from the frame and cover to the piping.

3.9 SETTING OF GATE VALVES:

- A. Avoid setting valves under pavement except where shown on the drawings.
- B. Clean valve interior before installation.
- C. Set valve plumb, restrain ends of valves when indicated on the drawing.
- D. Set valve box cover flush with the finished grade. Valve box shall be centered over the operating nut.

3.10 SETTING OF CHECK VALVES:

- A. Check valves shall be installed in a vault, direct burial of check valves shall not be permitted.
- B. Check valves shall be set in the horizontal position, with adequate clearance to the structure to allow for movement of the lever and maintenance of the valve.
- C. Clean the interior of the valve and check its operation prior to installation.
- D. After installation, adjust the weight on the lever to provide proper operation in accordance with the manufacturer's recommendations.

3.11 INSPECTION OF SEWERS:

Inspect and obtain the Resident Engineer's approval. Thoroughly flush out before inspection. Lamp test between structures and show full bore indicating sewer is true to line and grade. Lip at joints on the inside of gravity sewer lines are not acceptable.

3.12 TESTING OF SANITARY SEWERS:

- A. Gravity Sewers and Manholes (Select one of the following):
 1. Air Test: Vitrified Clay Pipe ASTM C828. PVC Pipe, Uni-Bell B-6. The line shall be pressurized to 4 psi and allowed to stabilize. After pressure stabilization, the pressure shall be dropped to 3.5 Psi greater than the average back-pressure of any groundwater above the sewer. The minimum test time shall be as specified in Uni-Bell B-6.
 2. Exfiltration Test:
 - a. Subject pipe to hydrostatic pressure produced by head of water at depth of 900 mm (3 feet) above invert of sewer at upper manhole under test. In areas where ground water exists, head of water shall be 900 mm (3 feet) above existing water table. Maintain head of water for one hour for full absorption by pipe body before testing. During one hour test period, measured maximum allowable rate of exfiltration for any section of sewer shall be 11 L (3.0 gallons) per hour per 30 m (100 feet).
 - b. If measurements indicate exfiltration is greater than maximum allowable leakage, take additional measurements until leaks are located. Repair and retest.

3. Infiltration Test: If ground water level is greater than 900 mm (3 feet) above invert of the upper manhole, infiltration tests are acceptable. Allowable leakage for this test will be the same as for the exfiltration test.

B. Pressure (Force) Mains: Test at 690 kPa (100 psi) for two hours. Leakage shall be per the following:

$$L=J*D*\sqrt{P}/4500$$

Where:

L = Maximum Allowable Leakage in Gallons per Hour

J = Number of Joints in Test Area

D = Diameter of Pipe in Inches

P = Average Test Pressure (Psi)

C. Testing of Fiberglass Sewage Holding Tanks: No leakage at 35 kPa (5 psi) air pressure test with 5:1 safety factor. Test by Contractor after installation.

D. Testing of Concrete Wet Well: No leakage with the wet well completely filled with water for a duration of 4 hours.

END OF SECTION 33 30 00

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SECTION 33 40 00 - STORM DRAINAGE UTILITIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The publications shall be the most current issue.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M198	Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets
AASHTO M252	Corrugated Polyethylene Drainage Tubing

AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)

ACPA 01-102	Concrete Pipe Handbook
ACPA 01-103	Concrete Pipe Installation Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 497	Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
ASTM A 615/A 615M	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 32	Sewer and Manhole Brick (Made from Clay or Shale)
ASTM C 62	Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 76M	Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C 139	Concrete Masonry Units for Construction of Catch Basins and Manholes
ASTM C 150	Portland Cement
ASTM C 270	Mortar for Unit Masonry
ASTM C 476	Grout for Masonry
ASTM D 2321	Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2564	Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

ASTM D 3034	Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	Joints for Drain and Sewer Plastic Pipe Using Flexible Elastomeric Seals
ASTM D 4101	Propylene Plastic Injection and Extrusion Materials
ASTM F 667	Corrugated Polyethylene (PE) Pipe and Fittings
ASTM F 477	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 794	Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F 949	Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES:

SD-02 Shop Drawings

Precast concrete structures

Metal items

SD-03 Product Data

Concrete piping including fittings and jointing materials

Polyvinyl chloride (PVC) plastic piping including fittings and jointing materials

Corrugated plastic piping including fittings and jointing materials

Perforated Polyvinyl chloride (PVC) plastic piping including fittings and jointing materials

Perforated Corrugated HDPE piping including fittings and jointing materials

Subsurface drainage piping including fittings and jointing materials

Cast aluminum downspout fittings and jointing material

SD-07 Certificates

Pipeline and fittings, including factory-applied linings and joint materials

Cast-iron frames, covers, and gratings

Precast concrete structures

Submit certificates attesting that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the frequency or intervals specified in the publication. Other tests shall have been performed within 3 years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

1.3.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.3.1.2 Metal Items

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

1.3.2 Handling

Handle pipe, fittings, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Carry, do not drag pipe to trench.

PART 2 PRODUCTS

2.1 PIPELINE AND CULVERT MATERIALS

2.1.1 Concrete Piping

2.1.1.1 Concrete Pipe and Fittings

Storm drainage pipe shall be reinforced concrete pipe conforming to ASTM C 76, Class III or Class IV per plans. Cement used in manufacturing pipe and fittings shall be Type II conforming to ASTM C 150.

2.1.1.2 Jointing Materials for Concrete Piping

Gaskets and pipe ends for rubber gasket joint shall conform to ASTM C 443. Gaskets shall be suitable for use with sewage.

2.1.2 Polyvinyl Chloride (PVC) Plastic Piping

2.1.2.1 PVC Plastic Pipe and Fittings

ASTM D 3034, shall be SDR 35, having ends adaptable for elastomeric gasket joints.

2.1.2.2 Joints and Jointing Material for PVC Plastic Piping

Joints shall conform to ASTM D 3212. Gaskets shall conform to ASTM F 477.

Polyvinyl Chloride (PVC) Pipe and Fittings, 10 Inch Diameter and Smaller: ASTM D 3034, SDR 35, with ends suitable for elastomeric gasket joints. ASTM F 949 with solvent cement joints or elastomeric gasket joints. ASTM D 3212 elastomeric gasket joints, ASTM D 2564 solvent cement joints and ASTM F 477 gaskets.

2.1.3 Corrugated Plastic Piping

2.1.3.1 Pipe and Fittings

Corrugated polyvinyl chloride (PVC) pipe conforming to ASTM F 794 or corrugated, high density polyethylene pipe (HDPE) conforming to AASHTO M252.

2.1.3.2 Joints and Jointing Materials

ASTM D 3212 for PVC pipe joints or manufacturer's recommendations for HDPE joints.

2.1.4 Perforated Plastic Pipe and Fittings

2.1.4.1 Pipe and Fittings

Perforated polyvinyl chloride (PVC) pipe conforming to ASTM 3034 or corrugated, perforated high-density polyethylene pipe (HDPE) conforming to ASTM F667.

2.1.4.2 Joints and Jointing Materials

ASTM D 3212 for Perforated PVC pipe joints or manufacturer's recommendations for Perforated HDPE joints

2.2 CONCRETE MATERIALS

Provide 4,000 PSI concrete as specified in Section 03 30 53, "Miscellaneous Cast-In-Place Concrete."

2.3 MISCELLANEOUS MATERIALS

2.3.1 Drainage Structures

Precast structures may be provided in lieu of cast-in-place concrete. Pipe-to-wall connections shall be mortared to produce smooth transitions and watertight joints or provided with ASTM C 923 resilient connectors. Bases shall have smooth inverts accurately shaped to a semicircular bottom conforming to the inside contour of the adjacent sewer sections. Changes in direction of the sewer and entering branches into the manhole shall have a circular curve in the manhole invert of as large a radius as the size of the manhole will permit.

2.3.1.1 Precast Concrete Structures

ASTM C 478, except as specified herein. Provide a minimum wall thickness of 5 inches. ASTM A 615/A 615M reinforcing bars. ASTM A 497 welded wire fabric. ASTM C 443 or AASHTO M198, Type B gaskets for joint connections. Provide a 4-inch layer of clean gravel bedding with a maximum size of 2 inches.

2.3.2 Masonry Materials

Shall conform to the following specifications and other requirements specified hereunder.

2.3.2.1 Brick

ASTM C 32, Grade MS, or ASTM C 62, Grade SW, except that the absorption test will be waived.

2.3.2.2 Concrete Masonry Units

ASTM C 139.

2.3.2.3 Mortar

ASTM C 270, Type M.

2.3.2.4 Water

Water for masonry mortar shall be fresh, clean, potable.

2.3.2.5 Grout

ASTM C 476.

2.3.3 Metal Items

2.3.3.1 Frames, Covers, and Gratings

Shall be cast iron as indicated conforming to ASTM A 48, Class 35B or ductile iron, conforming to ASTM A 536.

2.3.3.2 Drainage Structure Steps

Zinc-coated steel as indicated conforming to 29 CFR 1910.27. As an option, plastic or rubber coating pressure-molded to the steel may be used. Plastic coating shall conform to ASTM D 4101, copolymer polypropylene. Rubber shall conform to ASTM C 443, except shore A durometer hardness shall be 70 plus or minus 5. For curb inlets, steel sump ladder rungs as indicated may be used in lieu of cast-iron steps; rungs shall be zinc-coated after fabrication. Aluminum steps or rungs will not be permitted. Steps are not required in manholes, curb inlets, or catch basins less than 4 feet deep.

2.3.3.3 Downspout Boot Connectors

Shall be round-cast aluminum as indicated conforming to ASTM B 26/B 26M.

2.4 FLARED ENDS

Flared end sections shall be same material as pipe material except that only reinforced concrete flared ends shall be provided for concrete pipe.

2.5 EROSION CONTROL RIPRAP

Provide non-erodible rock not exceeding 15 inches in its greatest dimension and choked with sufficient small rocks to provide a dense mass with a minimum thickness of 8 inches or as indicated. Minimum weight shall be 50 pounds per unit.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

3.1.1 General Requirements for Installation of Pipelines

These requirements shall apply to pipeline installation except where specific exception is made under paragraph entitled "Special Requirements."

3.1.1.1 Location

The work covered by this section shall terminate at a point approximately 5 feet from the building, unless otherwise indicated on the drawings.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 31 00 00, "Earthwork."

3.1.1.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; remove those found defective from site and replace with new. Provide proper facilities for lowering sections of pipe into trenches. Lay pipe with the bell ends in the upgrade direction. Adjust spigots in bells to produce a uniform space. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper dimensions any pipe or fitting that does not allow sufficient space for proper caulking or installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose.

3.1.1.4 Connections to Existing Lines

Notify Contracting Officer in writing at least 10 days prior to date that connections are to be made. Obtain approval of the Contracting Officer before interrupting service. Conduct work so that there is minimum interruption of service on existing line.

3.1.2 Special Requirements

3.1.2.1 Installation of Concrete Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the provisions for rubber gasket jointing and jointing procedures of ACPA 01-103 or of ACPA 01-102, Chapter 9. Make joints with the gaskets previously specified for joints with this piping. Clean and dry surfaces receiving lubricants, cements, or adhesives. Affix gaskets to pipe not more than 24 hours prior to the installation of the pipe. Protect gaskets from sun, blowing dust, and other deleterious agents at all times. Before installation of the pipe, inspect gaskets and remove and replace loose or improperly affixed gaskets. Align each pipe section with the previously installed pipe section, and pull the joint together. If, while pulling the joint, the gasket becomes loose and can be seen through the exterior joint recess when the pipe is pulled up to within one inch of closure, remove the pipe and remake the joint.

3.1.2.2 Installation of PVC Plastic Piping

Install pipe and fittings in accordance with the "General Requirements for Installation of Pipelines" and with the requirements of ASTM D 2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping; assemble in accordance with the requirements of ASTM D 2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.1.2.3 Installation of Corrugated Plastic Piping

Install pipe and fittings in accordance with the "General Requirement for Installation of Pipelines" and with the recommendations of the PVC or HDPE pipe manufacturer.

3.1.2.3 Installation of Perforated Plastic Piping

Install pipe and fittings in accordance with the "General Requirement for Installation of Pipelines" and with the recommendations of the PVC or HDPE pipe manufacturer.

3.1.3 Concrete Work

Perform cast-in-place concrete work in accordance with Section 03 30 53, "Cast-In-Place Concrete."

3.1.4 Manhole, Curb Inlet, and Catch Basin Construction

Construct base slab of cast-in-place concrete or use precast concrete base sections. Make inverts in cast-in-place concrete and precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent drainage sections. For changes in direction of drains and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit. For cast-in-place concrete construction, either pour bottom slabs and walls integrally or key and bond walls to bottom slab. For precast concrete construction, make joints between sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping. Give a smooth finish to inside joints of precast concrete manholes, curb inlets, and catch basins. Parging will not be required for precast concrete manholes. Cast-in-place concrete work shall be in accordance with the paragraph entitled, "Concrete Work." Make joints between concrete manholes and pipes entering manholes with the resilient

connectors specified for this purpose or mortared to produce a watertight joint; install in accordance with the recommendations of the connector manufacturer. Where a new manhole is constructed on an existing line, remove existing pipe as required to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding beyond into the manhole.

3.1.5 Metal Work

3.1.5.1 Workmanship and Finish

Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron and steel to shape and size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide rabbets, lugs, and brackets wherever necessary for fitting and support.

3.1.5.2 Field Painting

After installation, clean cast-iron frames, covers, gratings, and steps not buried in masonry or concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Owner/Engineer or designee, will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed properly in accordance with the drawings and specifications.

3.2.2 Pipeline Testing

Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the adjoining end of line.

END OF SECTION 33 40 00