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RUTHERFORD
& ASSOCIATES, INC.**

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PROJECT MANUAL

**CITY OF
PANAMA CITY BEACH**

**PUBLIC WORKS
HURRICANE SAFE ROOM**

PANAMA CITY BEACH, FLORIDA

CRA PROJECT NUMBER: 23007

AUGUST 7, 2023

CONSTRUCTION BID DOCUMENTS

SET NUMBER:

CLEMONS, RUTHERFORD & ASSOCIATES, INC.

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SECTION 000700 - GENERAL CONDITIONS

The "General Conditions of the Contract for Construction", The American Institute of Architects' (AIA) Document A201-2017, forty-one (41) pages, is included herein.

END OF SECTION 000700

 AIA® Document A201™ – 2017**General Conditions of the Contract for Construction**

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

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

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ADDITIONS AND DELETIONS:

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

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

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

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

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

§ 1.1.2 The Contract

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

§ 1.1.3 The Work

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

§ 1.1.4 The Project

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

§ 1.1.5 The Drawings

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

§ 1.1.6 The Specifications

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

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

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

§ 1.2 Correlation and Intent of the Contract Documents

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

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

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

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

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

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

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

§ 1.6 Notice

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

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

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document

G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

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

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

§ 2.2 Evidence of the Owner's Financial Arrangements

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

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

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

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

§ 2.3 Information and Services Required of the Owner

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

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

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

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

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

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

§ 2.4 Owner's Right to Stop the Work

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

§ 2.5 Owner's Right to Carry Out the Work

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

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

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

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

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

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

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

§ 3.3 Supervision and Construction Procedures

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

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

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

§ 3.4 Labor and Materials

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

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

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

§ 3.5 Warranty

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

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

§ 3.6 Taxes

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

§ 3.7 Permits, Fees, Notices and Compliance with Laws

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

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

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

§ 3.7.4 Concealed or Unknown Conditions

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

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

§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

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

§ 3.9 Superintendent

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

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

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

§ 3.10 Contractor's Construction and Submittal Schedules

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

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

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

§ 3.11 Documents and Samples at the Site

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

delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

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

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

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

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

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

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

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

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

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

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

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely

upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

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

§ 3.13 Use of Site

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

§ 3.14 Cutting and Patching

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

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

§ 3.15 Cleaning Up

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

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

§ 3.16 Access to Work

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

§ 3.17 Royalties, Patents and Copyrights

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

§ 3.18 Indemnification

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

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

ARTICLE 4 ARCHITECT

§ 4.1 General

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

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

§ 4.2 Administration of the Contract

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

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

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

§ 4.2.4 Communications

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

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

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

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

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

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

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

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

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

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

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

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

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

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

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

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

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

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

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

§ 5.3 Subcontractual Relations

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

§ 5.4 Contingent Assignment of Subcontracts

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

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

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

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

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

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

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

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

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

§ 6.2 Mutual Responsibility

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

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

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

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

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

§ 6.3 Owner's Right to Clean Up

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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

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

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

§ 7.2 Change Orders

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

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

§ 7.3 Construction Change Directives

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

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

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

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

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

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

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

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

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

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

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

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

§ 7.4 Minor Changes in the Work

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

ARTICLE 8 TIME

§ 8.1 Definitions

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

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

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

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

§ 8.2 Progress and Completion

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

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

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

§ 8.3 Delays and Extensions of Time

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

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

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

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

§ 9.2 Schedule of Values

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

§ 9.3 Applications for Payment

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

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

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

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

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

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

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

§ 9.5 Decisions to Withhold Certification

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

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;

- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

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

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

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

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

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

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

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

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

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

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

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

§ 9.7 Failure of Payment

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

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

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

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

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

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

§ 9.9 Partial Occupancy or Use

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

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

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

§ 9.10 Final Completion and Final Payment

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

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

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

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

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

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

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

§ 10.2 Safety of Persons and Property

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

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

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

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

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

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

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

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

§ 10.2.8 Injury or Damage to Person or Property

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

§ 10.3 Hazardous Materials and Substances

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

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will

promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

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

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

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

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

§ 10.4 Emergencies

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

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

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

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

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

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or

expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

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

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

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

§ 11.3 Waivers of Subrogation

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

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

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

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

§11.5 Adjustment and Settlement of Insured Loss

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

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

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

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

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

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

§ 12.2.2 After Substantial Completion

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

that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

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

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

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

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

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

§ 12.3 Acceptance of Nonconforming Work

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

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

§ 13.2 Successors and Assigns

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

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

§ 13.3 Rights and Remedies

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

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

§ 13.4 Tests and Inspections

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

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

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

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

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

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

§ 13.5 Interest

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

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

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

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

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

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

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

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

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

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

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

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

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

§ 14.3 Suspension by the Owner for Convenience

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

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

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

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

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

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

- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

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

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

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

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

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

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

§ 15.1.4 Continuing Contract Performance

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

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

§ 15.1.5 Claims for Additional Cost

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

§ 15.1.6 Claims for Additional Time

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

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

§ 15.1.7 Waiver of Claims for Consequential Damages

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

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

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

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

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

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

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

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

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

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

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

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

§ 15.3 Mediation

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

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

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

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

§ 15.4 Arbitration

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

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

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

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

§ 15.4.4 Consolidation or Joinder

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

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

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

SECTION 008000 – SUPPLEMENTARY GENERAL CONDITIONS

SUPPLEMENTS TO A.I.A. DOCUMENT A201, 2017 EDITION GENERAL CONDITIONS FOR THE CONTRACT FOR CONSTRUCTION

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GENERAL

These Supplementary General Conditions modify, change, delete from, or add to the "General Conditions of the Contract for Construction," A.I.A. Document A201, 2017 Edition. The A.I.A Document A201, 2017 Edition is hereby made a part of every Section of these Specifications and shall be binding upon each Contractor, Subcontractor, and Material Supplier. Where any Article of the General Conditions is modified, or any Paragraph, Subparagraph, or Sub-Subparagraph thereof is modified or deleted by these Supplementary General Conditions, the unaltered provisions of the Article, Paragraph, Subparagraph, or Sub-Subparagraph shall remain in effect.

ARTICLE 1 - GENERAL PROVISIONS:

1.1 BASIC DEFINITIONS:

1.1 Supplement Paragraph 1.1 as follows:

“1.1.1.1 The General Contractor’s and Subcontractor’s Proposal Forms as accepted by the Owner shall be a part of the Contract Documents.

1.1.9 “Provide”, as used in the Contract Documents, includes furnishing all labor, supervision, tools, materials, supplies, equipment, shop drawings, product data and samples, together with all services, accessories and costs associated with performance of the work, or production or installation of an item or system usable in the complete project.

1.1.10 “Diagrammatic”, as used in the Contract Documents, shall mean to outline in schematic form or an illustration to be used as a guide only.

1.1.11 “Product”, as used in these Contract Documents, includes materials, systems and equipment.”

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS:

1.2.1 Delete subsection entirely and substitute the following:

“1.2.1 The intent of the Contract Documents is to include all items necessary for the execution and completion of the work by the Contractor. The Contract Documents are complementary, and what is required by anyone shall be as binding as if required by all. Performance by the Contractor and Subcontractors shall be required to produce the intended results. In cases of discrepancies between the Contract Documents, the Agreement shall take precedence over the Drawings and Specifications, and the Specifications shall take precedence over the Drawings, except as

SECTION 008000 – SUPPLEMENTARY GENERAL CONDITIONS (continued)

listed. Large scale plans, sections, and details take precedence over smaller scaled items. Plan schedules shall control over general plans. Addenda and Change Orders supersede only affected portions of the Documents.

1.2.1.1 The Contractor/Subcontractor, however, shall be held to providing completed work, according to the meaning and intent of the Drawings and Specifications whether all the items involved under any trade are mentioned in one or several sections or on one or several drawings.

1.2.1.2 Should any item to be furnished or labor to be performed as specified under more than one Section of the Specification, it will be premised that Subcontractors have included said product and/or labor in more than one Section, unless he shall have obtained a written decision from the Construction Manager prior to the bid. The Construction Manager will decide who shall provide such items. Proper credit shall be given to the Owner when the cost has been included more than once.

1.2.1.3 Should any item or equipment required to be furnished within the drawings or specifications fail to have any or all of its connections or utilities indicated, the Contractor and Subcontractors shall provide (as a minimum) services, utilities and connections to ensure the permanent, proper, code compliant operation of the item or equipment; unless such condition shall have been brought to the attention of the Architect prior to the Bid and a decision rendered through the issuance of addenda or other items of clarification.

1.2.1.4 The Contractor, and Subcontractors shall not take advantage of errors or omissions on Drawings or Specifications.

1.2.1.5 If any errors or omissions appear in Drawings, Specifications, or other Contract Documents, the Subcontractors shall notify the Contractor before time of submitting bid. The Contractor will notify and resolve the issues with the Architect prior to submitting a guaranteed maximum price or Bid Proposal to the Owner. Should conflict occur in or between Drawings and Specifications; Contractor and Subcontractors are deemed to have estimated on the more expensive product, method of installation, and/or the greater quantity, unless he has requested and obtained a written decision before submission of bid proposals as to which method, product, or quantity will be required.

1.2.1.6 References to known standard specifications shall mean the latest edition of such specifications adopted and published at date of invitation to submit proposal. Words which have well-known technical or trade meanings are used herein accordance with such recognized meanings.

1.2.1.7 When dimensions as shown on the Drawings are affected by conditions already established, the Subcontractor shall take measurements to verify the given scale or figure dimensions in the Drawings.

1.2.1.8 The Specifications, detailed description or omission of it, concerning any work to be provided shall be regarded as meaning that only the best general practice of the trade is to prevail and that only materials and workmanship of the first quality are to be used. All interpretations of these Specifications shall be made upon this basis and all interpretations shall be made by the Architect.

1.2.1.9 Execute work as per Contract Documents. Make no changes without having first received written permission from the Architect. Where detailed information is lacking, before proceeding with work, refer matter to the Architect for additional information.

1.2.1.10 THE MECHANICAL AND ELECTRICAL SYSTEM DRAWINGS ARE DIAGRAMMATIC IN NATURE AND THE FIELD CONDITIONS MAY ARISE THAT WILL PREVENT THEIR BEING INSTALLED AS PER DRAWING (EX.), SUCH AS PIPE AND CONDUIT RUNS, CROSSEOVERS, RISERS, DOORS, FLOOR, WALLS AND CEILING PATTERN COVERING LAYOUTS, ETC. THEREFORE, IT SHALL BE THE RESPONSIBILITY OF EACH AND ALL SUBCONTRACTORS, FOR THE COORDINATION, TIMING AND PROTECTION OF ALL CONDITIONS; AND IN EACH CASE WHERE THERE IS ANY QUESTION OR PROBLEM AS TO CONDITIONS OR LOCATIONS OF THESE ITEMS, SUBMIT A WORKABLE SOLUTION TO THE CONSTRUCTION MANAGER/GENERAL CONTRACTOR AND THE ARCHITECT FOR REVIEW AND WRITTEN APPROVAL BEFORE COMMENCING WITH QUESTIONABLE WORK. IF SUCH ADJUSTMENT SHALL BE MADE BY THE SUBCONTRACTOR WITHOUT WRITTEN APPROVAL, IT SHALL BE AT THEIR OWN RISK AND EXPENSE. ANY REMOVAL OF NON-APPROVED AREAS SHALL BE THE RESPONSIBILITY AND EXPENSE OF THE SUBCONTRACTORS.

1.2.1.11 Where there is conflict between the Drawings, or between Drawings and Specifications, or doubt as to meaning, the Contractor and Subcontractors shall obtain a written decision from the Architect, except where the Contractor deems that there could be immediate damages to life or property. He shall not proceed in uncertainty in any instance.

1.2.1.12 In the case of discrepancies between the INFORMATION TO BIDDERS, CONDITIONS OF THE CONTRACT, DRAWINGS, SPECIFICATIONS, OR ADDENDA as it relates to each Subcontractor's Work Category responsibilities, the most stringent and/or most expensive case applies as determined by the Architect."

SECTION 008000 – SUPPLEMENTARY GENERAL CONDITIONS (continued)

1.2.2 Add the following:

“1.2.2.1 Construction Specifications Institute (C.S.I. Uniform System): To assist the Contract, the Specifications are divided into Divisions and Section numbers generally conforming to "Uniform System for Construction Specifications.”

ARTICLE 2 - OWNER:

2.1 GENERAL:

2.1.1 Add the following subparagraphs:

“2.1.1.1 THE TERM "ARCHITECT" AS USED IN THE GENERAL CONDITIONS SHALL MEAN ‘Clemons, Rutherford & Associates, Inc.’ WHERE THE TERM "A/E", "ARCHITECT/ENGINEER", OR "ENGINEER" IS USED IN THE DOCUMENTS, IT SHALL BE CONSIDERED AS BEING SYNONYMOUS WITH THE TERM "ARCHITECT" AS DEFINED IN THE GENERAL CONDITIONS.

2.1.1.2 The use of phrases "as directed", "as instructed", "reviewed", "authorized", "accepted", and similar terms implies that such action will be taken by the Architect unless specifically stated otherwise.”

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER:

2.2.5.1 Add the following:

“2.2.5.1 The Contractor will be furnished with ONE (1) reproducible digital (PDF format) set of Drawings and Specifications by the Owner (other sets may be furnished but are not a requirement under this contract). A complete set of portable document format (.pdf) documents (plans and specifications) will be made available to the Contractor for the printing processes. The Contractor will make the portable document format documents available to the Subcontractors. The Architect will provide the Contractor with the original digital BIM Revit Model and/or AutoCAD files of the building and site for the Contractor’s and Subcontractor’s use to prepare Shop Drawings, Coordination Drawings, and Submittals upon receipt of accepted AIA Documents E203-2013 and G201-2013 Digital Protocol Agreements and the Architect’s Digital File Release Forms from all users.”

2.4 OWNERS RIGHT TO CARRY OUT THE WORK:

2.4.1 Add the following:

“2.4.1 The Owner will assist the Architect and Contractor in determining in general that the Work of the Subcontractors is being performed in accordance with the Contract Documents and will endeavor to guard the Owner against defects and deficiencies in the Work of the Contractor and Subcontractors.”

ARTICLE 3 - CONTRACTOR:

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR:

3.2.1 Add the Following:

“3.2.1.1 Examination of site shall include determination of the nature and scope of the work and all difficulties that accompany its execution. The Contractor shall be responsible for coordinating with the owner to inspect and locate existing site conditions and providing existing as built drawings for the following existing site items documented by GPS coordinates:

Valve and Valve Boxes, Main Water and Sewer tie-ins, Clean outs and Junction Boxes

Chilled Water Lines, main water lines, main gas lines and electrical conduits.

Existing change of directions for chilled water lines, main water lines, main gas lines, irrigation lines and electrical conduits.

Electrical Transformers.

3.2.3 Add the following:

“3.2.3.1 The Contractor, Subcontractors and material suppliers shall examine the Architectural, Structural, Mechanical, Plumbing, and Electrical Drawings and Specifications, and verify all measurements and requirements before ordering materials or performing any work to avoid problems during construction.

SECTION 008000 – SUPPLEMENTARY GENERAL CONDITIONS (continued)

3.2.3.2 Before ordering materials or doing any work, the Contractor and Subcontractors shall verify all measurements at the project site and shall be responsible for their correctness. No extra compensation will be allowed on account of differences between actual dimensions and those indicated on the Drawings. Any decided difference which may be found shall be reported to the Architect in writing, for consideration before proceeding with the Work.”

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES:

Add the following Subparagraph 3.3.2.1 through 3.3.2.7:

3.3.2.1 The Contractor and/or subcontractor and their employees shall refrain from use of vulgarities around staff.

3.3.2.2 Clothing shall have no vulgarities or sexually suggestive graphics.

3.3.2.3 Direct contact with staff is strictly prohibited.

3.3.2.4 Violation of Special Conditions may result in immediate termination of that employee, Contractor or Subcontractor.

3.3.2.5 State regulations prohibit alcohol, drugs, and firearms from being brought onto the property. Violators will be prosecuted under State Law.

3.3.2.6 There shall be no smoking or use of tobacco products which include e-cigarettes, allowed in any facility or on any real or personal property owned by or under the control of the City of Panama City Beach. Contractor and Subcontractor employees are required to leave the site for tobacco use. Job-site trailers are not exempt from this requirement.

3.3.2.7 The Contractor shall present a plan, for approval by the Owner, showing all areas for safety fencing staging, storage, job office, ingress and egress to the site. No work shall be done until this is approved.

3.4 LABOR AND MATERIALS:

3.4.1 Add the following:

“3.4.1.1 Material Standards - Unless otherwise specifically provided in this Contract, reference to any equipment, material, article, or patented process, by trade name, make, or catalog number, shall establish a standard of quality and the Base Bid shall include only materials and items exactly as specified or called for by name. Architect to list at least three acceptable manufacturers in the Specifications, where possible, however each manufacturer shall meet the basis-of-design requirements.”

3.4.2 Delete subparagraph 3.4.2 and substitute the following:

“3.4.2 Substitutions During Bidding Period - Requests for Substitutions during the bidding period will be considered and treated only as stated in Specification Section 008200, Special Conditions, Article 15, Substitution of Materials and Equipment. Once bids have been received, the Owner and Architect will prepare the Contract on the basis that all items are those specified in the Specifications, shown on the Drawings, or approved in Addenda during the bidding period. The approval of a product during the bid period does not negate the requirement for the submission of complete data during the construction in accordance with the Section 013300, Submittals, nor does it negate the burden of complying with all specification requirements. Should further investigation of a product approved during the bid period indicate that the product does not meet the essential requirements of the project the Contractor and Subcontractors shall make such modifications as are necessary to meet these essential requirements.

3.4.2.1 Approval After Bids are Opened - Substitutions or approval of products will be considered after bids are opened only under the following conditions:

.1 The Subcontractor shall place orders for specified materials and equipment promptly upon award of Contract. No excuses or proposed substitutions will be considered for materials and equipment due to unavailability, unless proof is submitted that firm orders were promptly placed for the item listed in the Specifications.

.2 The reason for the unavailability shall be beyond the control of the Subcontractor, such as strikes, lockouts, bankruptcy, discontinuance of the manufacturer or a product, or acts of god, and shall be made known in writing to the Architect within ten (10) days of the date that the Subcontractor ascertains that he cannot obtain the material or equipment specified. Requests shall be accompanied by a complete description of the materials or equipment which the Subcontractor wishes to use as a substitute.”

SECTION 008000 – SUPPLEMENTARY GENERAL CONDITIONS (continued)

3.5 WARRANTY:

Add the following:

“3.5.1 Under this warranty for a period of one (1) year from date of Completion, as evidenced by the date of "Substantial Completion" of the Work, the Contractor and Subcontractors shall remedy, at his own expense, any such failure to conform on any such defects. Where warranties are written in any Section for longer than one (1) year, such terms will apply.

3.5.2 Nothing in the above intends or implies that this warranty shall apply to work which has been abused or neglected by the Owner.”

3.6 TAXES:

3.6 Add the following:

“3.6.1 Unless otherwise specified, the Bid price includes all Federal, State and local taxes imposed prior to the execution of the Agreement and which are applicable to the Work. If any new privilege, sales gross receipt or other excise tax, exclusive of taxes and net income or undistributed profit applicable to the Work and payable by the Subcontractor is imposed by the State of Florida, or such present tax be increased as of the date thereof, then the Contract price will be adjusted accordingly and the Owner will reimburse the Contractor therefore without any allowance for overhead or profit upon separate payment application containing such pertinent details as the Owner may require. The Contractor will organize, implement and manage the Owner’s direct purchase tax recovery program. Direct purchases shall be for orders of five-thousand dollars (\$5,000) or more for any single item.”

3.7 PERMITS, FEES, NOTICES AND COMPLIANCE WITH LAWS:

3.7 Delete paragraph 3.7.1 and substitute the following:

“3.7.1 A local building permit will be required for this project.

3.7.1.1 Before proceeding with the Work, securing permits or necessary licenses, the Contractor and Subcontractors shall carefully study and compare the Drawings and Specifications and shall at once report in writing, to the Architect/Engineer, any error or omission he may discover that is in variance with applicable laws, statutes, building codes, and regulations.”

3.7.2 Add the following:

“3.7.2.1 The Contractor and Subcontractors at all times shall comply with the Florida Building Code 2023 installation requirements (including amendments and supplements), and all Federal, State and local laws, codes, ordinances and regulations as applicable, which in any manner affects the Work, and he and his surety shall indemnify and hold harmless the Owner, and Architect/Engineer, to the extent allowable by law, against any claim or liability arising from or based on the violation of such law or decree, whether by himself or his employees.”

3.10 CONTRACTOR’S CONSTRUCTION AND SUBMITTAL SCHEDULES:

Add the following Subparagraphs 3.10.5 through 3.10.7:

3.10.5 The Contractor shall furnish sufficient forces, construction plant and equipment, and shall work such hours, including night shifts and overtime operations, as may be necessary to insure the prosecution of the Work in accordance with the approved progress schedule. If the Contractor falls behind the progress schedule, the Contractor shall take such steps as may be necessary to improve the progress by increasing the number of shifts, overtime operations, days of work and the amount of construction plant, all without additional cost to the Owner.

3.10.6 Failure of the Contractor to comply with the requirements under this provision shall be grounds for determination by the Engineer that the Contractor is not prosecuting the work with such diligence as will insure completion within the time specified and such failure constitutes a substantial violation of the conditions of the Agreement.

3.10.7 Upon such determination, the Owner may terminate the Contractor’s right to proceed with the work, or any separable part thereof, in accordance with Article 14 of the General Conditions, or may withhold further payments as indicated in Article 9.5.1.

SECTION 008000 – SUPPLEMENTARY GENERAL CONDITIONS (continued)

3.11 DOCUMENTS AND SAMPLES AT THE SITE:

3.11.1 Add the following:

“3.11.1 At the completion of the Work, each Subcontractor shall submit "Record Drawings" to the Contractor on digital media, and the Contractor in turn will produce (or cause to have produced) As-Built Drawings on ELECTRONIC MEDIA on Autodesk AutoCAD Architectural Desktop (2023 Version). The Architect will provide the Contractor with the digital related AutoCAD files of the project for the Contractor's and Subcontractor's use to prepare Shop Drawings, Coordination Drawings, and As-Built (Record) Drawings upon receipt of accepted AIA Documents E203-2013 and G201-2013 Digital Protocol Agreements and the Architect's Digital File Release Forms from all users. Said Record Drawings shall be delivered to the Architect for review. The Architect will forward reviewed Final As-Built Drawings to the Owner for their future use.

3.11.1.1 Pipelines and ducts which are installed in furred spaces, pipe chases, or other spaces which can be readily inspected using access panels or other means of access will not be considered as being concealed. With reference to electrical and mechanical work the exact (not diagrammatic) conduit, pipe, and duct runs shall be shown on these drawings.

3.11.1.2 Record Drawings" shall be the daily in-use set of contract documents at the job site. At the end of each day, the foreman of each trade shall mark and date any and all changes that occurred during the day's work. Lines shall be located by dimension and equipment shall be noted and located. These documents will be delivered to the Contractor as noted in 3.11.1 above.

3.11.1.3 Upon completion of the work this data shall be recorded to scale, by a competent draftsman on electronic media copies of the contract drawings. Where changes and actual locations are to be recorded, the electronic media shall be erased before the changes are made. The work shall be shown as installed and the Contractor shall deliver the black line drawing prints and electronic media files with every drawing marked "As-Built". In showing the changes the same legend shall be used to identify piping, etc., as was used on the contract drawings. A separate set of drawings shall be prepared for electrical, plumbing, heating, air conditioning, and ventilating work, and A/V & Data, unless two (2) or more divisions are shown on the same sheets of the contract drawings. Each change of the original Contract Documents shall be "clouded" and referenced, except pipe runs may be noted, and each sheet shall bear the date and name of the Subcontractor submitting the changes to the drawings.

In addition, Contractor shall provide the following upon completion of the project:

- Electrical:
 - o Panel schedule to be verified by Engineer of Record
 - o On the Receptacle show label with Panel and Breaker
 - o On Main Panel label phase rotation
 - o Provide permanent Tag on Transformer for every main panel going to Transformer.
 - o Provide on every Panel and switchgear paired Transformer
 - o Provide the following standard color coding on J-Boxes:
 - Red – Fire Alarm
 - Yellow – 120/208/240 low voltage
 - Orange – 277/480 high voltage
 - Green – Camera
 - Blue – Communication/AV
- Plumbing:
 - o For Valve Boxes above Ceiling locations, provide orange/blue stencil at grid intersection nearest to Valve Box
- Mechanical:
 - o For Fire Damper, Air Damper locations provide pop-rivet sign
- Site As-Built drawings shall include the following:
 - o location of all existing valves and valve boxes by GPS coordinates
 - o location of all new valves and valve boxes by GPS coordinates.
 - o location of main sewer service tie in points by GPS coordinates.
 - o location of main water tie in points by GPS coordinates.
 - o location of clean outs and junction boxes by GPS coordinates.
 - o line drawings for chilled water lines, main water lines, main gas lines, Electrical lines.
 - o change of direction for chilled water lines, main water lines, main gas lines, electrical lines.
 - o Electrical Transformer location by GPS coordinates.

SECTION 008000 – SUPPLEMENTARY GENERAL CONDITIONS (continued)

3.11.1.4 The Contractor shall review the complete as-built drawings. He shall ascertain and certify that all data furnished on the drawings are accurate and truly represent the work as actually installed. When manholes, boxes, underground conduits, plumbing, hot or chilled water lines, inverts, etc. are involved as part of the work, the Subcontractor shall furnish true elevations and locations, all properly referenced by using the original benchmark for the project. The “Record Drawings” from each Subcontractor, including those unchanged and changed, shall be submitted to the Architect, when completed, together with three (3) sets of black line prints (produced from the As-Built Electronic Media) with the Contractor’s stamp and each Subcontractor’s certification for forwarding to the Owner, at the time of Substantial Completion. Final payment shall not be made until said “As-Built” documents have been received by the Architect, reviewed and accepted as complete, and in accordance with the contract documents.

3.11.1.5 The Contractor shall be responsible for collecting, identifying, indexing and collating the specified Close-Out Documents including the following materials from the Subcontractors, and will deliver three (3) copies of the finished documents to the Architect. Complete equipment diagrams, operating instructions, maintenance manuals, parts lists, wiring diagrams, pneumatic and/or electrical control diagrams, test and balance reports, inspection reports, guarantee and warranties, as applicable for each and every piece of fixed equipment furnished under this contract to be supplied in a three ring binder, hard-cover book, properly indexed for ready reference. Also, specific information regarding manufacturer’s name and address, nearest distributor and service representative’s name and address, office and home phone numbers, make and model numbers, operating design and characteristics, etc. will be required. All information submitted shall be updated to reflect existing conditions. Final payment shall not be made until said documents have been received by the Architect/Engineer, reviewed and accepted as complete and in accordance with the contract documents. Also refer to Section 01 77 00, Close-Out Procedures.”

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES:

3.12.11 Add the following Subparagraph:

“3.12.11 The requirements of Article 3.12 are supplemented by a separate Section, Submittals in Division One, Section 013300.”

3.14 CUTTING AND PATCHING OF WORK:

3.14 Add the following Subparagraphs:

“3.14.3 The Subcontractor shall do all cutting required for installation of his work. Patching required because of such cutting shall be performed as follows:

3.14.3.1 Wherever cutting occurs within unexposed materials, or in materials which are to remain unfinished when completed, patching shall be performed by the Subcontractor who did the cutting. This includes all concrete and masonry other than listed below.

3.14.3.2 Wherever cutting occurs in finished surfaces, patching shall be performed by the Subcontractor specializing in that particular trade, and paid for by the Subcontractor who did the cutting. This includes, but is not limited to, roofing, painting of plaster and finished surfaces, ceramic tile, structural facing tile, marble, concrete block in finished areas, metal lath and plaster, acoustical materials and their supports.”

ARTICLE 4 - ARCHITECT:

4.1 GENERAL:

4.1 Add the following paragraph:

“4.1.4 Disputes arising under Subparagraph 4.1.2 and 4.1.3 shall be subject to litigation.”

ARTICLE 5 - SUBCONTRACTORS:

5.1 DEFINITIONS:

5.1 Add the following:

“5.1.3 Material Supplier is a person or organization who has furnished materials to the General Contractor, Subcontractor, Sub-subcontractor or Owner to be used in the construction of the Work, a building or structure, but has not performed any on or off site work other than delivering construction materials, and shall not have or created any contractual relation between the Owner or the Architect/Engineer.

SECTION 008000 – SUPPLEMENTARY GENERAL CONDITIONS (continued)

5.1.4 The Contractor, and all Subcontractors, Sub-Subcontractors and Material Suppliers shall be responsible for reading, studying, and understanding the Conditions of the Contract, Drawings and Specifications.”

ARTICLE 6 - CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS:

6.4 Add the following paragraph:
“6.4 INSTALLATION OF EQUIPMENT:

6.4.1 The Contractor and Subcontractors shall allow the Owner to take possession of the use of any completed portions of this structure or Work, or to place and install as much equipment and machinery during the progress of the Work, as is possible without interference before its entire completion. Such possession and use of structure of work or such placing and installation of equipment, or both, shall not in any way evidence the completion of the Work or any portion of it, or signify the Owner's acceptance of the Work or any portion of it.”

ARTICLE 7 -CHANGES IN THE WORK:

7.2 CHANGE ORDERS:

7.2 Add the following:
“7.2.2 The Contractor is responsible for all affected work that is a result of an approved Change Order. Any changes required as a result of a Change Order shall be reflected in the price of the Change Order. Any additional work that becomes necessary after the Change Order has been approved will be made at the Contractor's expense.”

7.3 CONSTRUCTION CHANGE DIRECTIVES:

7.3.3 Delete paragraph and substitute the following:
“7.3.3 The cost or credit to the Owner resulting from a change in the Work shall be determined as follows:
1. By Unit Prices stated in the Contract Documents or subsequently agreed upon; or for changes not covered by Unit Prices;
2. By mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation; or if no agreement can be reached,
3. By the method provided in Subparagraph 7.3.6.
The lump sum proposals shall be based upon:
1. Estimate of Labor.
2. Estimate of Materials.
3. Estimate of Applicable Taxes.
4. Estimate of Equipment Rentals.
5. Estimate of Subcontractor Costs.
6. Estimate of Contractor Costs.
7. Estimate of Field Supervision (directly attributed to change) shall be included in labor breakdown.
8. Cost of Bond Premium.
9. Contractor and Subcontractor overhead and profit applied to the above items shall not exceed fifteen percent (15%) percent in total. Subcontractor overhead and profit shall not exceed ten percent (10%). Contractor overhead and profit shall not exceed five percent (5%) plus the cost for related bond premium. All lump sum proposals shall include a detailed cost breakdown for each component of work indicating both quantities and unit prices shall be submitted to the Architect within seven (7) calendar days after receipt of the proposal request.”

7 3.7 Add the following:
“7.3.7.1.1 All labor, material, and equipment expenditures for work performed at actual cost shall be approved daily by the Construction Manager. Material invoices shall be presented to the Owner and Architect with all payment requests.
7.3.7.1.2 No amount or percentage of overhead and profit will be allowed on items of perks, fringe benefits, bonuses, retirement benefits (other than social security withholdings), or health and life insurances.”

SECTION 008000 – SUPPLEMENTARY GENERAL CONDITIONS (continued)

ARTICLE 8 - TIME:

8.2 PROGRESS AND COMPLETION

8.2 Add the following paragraph:

“8.2.4 Work shall be commenced by the date established in the Notice to Proceed, but in no case more than ten (10) consecutive calendar days after such date, and shall proceed in accordance with a schedule to be developed by the Contractor and presented to the Architect and the Owner’s Agent. The Contract Time is specified in the Agreement Between Owner and Construction Manager.

A. LIQUIDATED DAMAGES:

1. If the Contractor fails to achieve Substantial Completion of the Work within the Contract Time or as otherwise required by the Contract Documents, the Owner shall be entitled to retain or recover from the Contractor and/or its Surety, liquidated damages and not as a penalty, the per diem amounts specified in the Contract Between the Owner and Contractor, and commencing upon the first day following expiration of the Contract Time and continuing until the actual date of Substantial Completion for each Phase of Work identified. Such liquidated damages are hereby agreed to be a reasonable pre-estimate of damages the Owner would incur as a result of delayed completion of the Work.
2. The Liquidated Damages amount per calendar day are fixed and agreed upon by and between the Contractor and the Owner because of the impracticality and difficulty of ascertaining actual damages the Owner will sustain. The Owner will suffer financial damage if the Project is not substantially completed on the dates set forth in the Contract Documents. Therefore, it is agreed that the liquidated damages amount per calendar day is adequate to cover damages which the Owner will sustain by reason of the inconvenience, loss of use, loss of monies, additional costs of contract administration by the Architect and Owner.
3. Permitting the contractor to continue and finish the Work or any part of the Work after time fixed for its completion or after date to which time for completion may have been extended shall in no way constitute a waiver on the part of the Owner of any of his rights under the Contract.
4. Liquidated Damages shall also be assigned to the Contractor if punch list items have not been completed within the specified number of days after Substantial Completion. Liquidated Damages for punch list items shall commence on the after Substantial Completion is established and accrue until the final Application for Payment has been approved by the Architect. The Contractor, and its Surety, shall pay to the Owner the sums stipulated as fixed, agreed and liquidated damages for each calendar day of delay until the punch list items are complete.”

ARTICLE 9 - PAYMENTS AND COMPLETION:

9.5 DECISION TO WITHHOLD CERTIFICATION:

9.5 Add the following:

“9.5.4 The Architect may withhold or cause to be withheld, from any monies payable on account for work performed by the Contractor, or Subcontractor, such sums as may administratively be determined to be necessary to satisfy any liabilities of such Contractor or Subcontractors for damages.”

9.10 FINAL COMPLETION AND FINAL PAYMENT:

9.10.2 Add the following paragraph:

“9.10.2.1 Final payment consisting of the entire unpaid balance of the Contract Amount will be paid by the Owner to the Contractor thirty (30) days after receipt of the Final Certificate for Payment from the Architect, Close-Out Documents including Record Drawings, and the “Final Consent of Surety. Final Payment will not be made until all Close-Out Documents and As-Built Drawings have been submitted and approved.”

SECTION 008000 – SUPPLEMENTARY GENERAL CONDITIONS (continued)

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY:

10.2 SAFETY OF PERSONS AND PROPERTY:

10.2.2 Add the following subparagraph:

“10.2.2.1 This requirement shall include, but not necessarily be limited to, all health, safety, and fire protection regulations of the Florida Industrial Commission and the Department of Labor Safety and Health Regulations and construction promulgated under the Occupational Safety and Health Act of 1970 (P191-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (P191-54). These regulations are administered by the Department of Labor who shall have full access to the Project for inspection, etc. Compliance with the above is strictly and exclusively the responsibility of the Contractor and Subcontractors and shall in no event be considered reason for additional time or monetary compensation. In the event that a hurricane or storm emergency is imminent, the Subcontractor shall, at his own expense and without cost to the Owner, take all necessary measures to secure all his movable property, building work or plant in such a manner that no damage to public or private property or to persons may result by reason of displacement of the Subcontractor's material, equipment or plant during such hurricane or storm.”

10.2.7 Add the following subparagraph:

“10.2.7.1 The Subcontractor shall adequately protect preceding and existing Work from damage caused by his operations. Breakage or damage shall be repaired by the erector of the Work at cost to the party causing the damage. The Construction Manager shall be the sole judge determining the party causing the damage, notwithstanding any dispute resolution.”

ARTICLE 11 INSURANCE AND BONDS

11.1 CONTRACTOR'S LIABILITY INSURANCE

Delete Subparagraph 11.1.1 and substitute the following:

11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the State of Florida such insurance as will protect the Owner, Contractor, Architect and Architect's consultants from claims set forth below which may arise out of or result from the Contractor's operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable. All insurance policies shall be issued and countersigned by representatives of such companies duly authorized for the State of Florida and shall be written on ISO standard forms or their equivalents. The Contractor shall provide the ISO Commercial General Liability policy for general liability coverages. All liability policies shall provide that the Owner, City of Panama City Beach, is a named additional insured (being named as Certificate Holder is not acceptable) as to the operations of the Contractor under the Agreement and shall provide the Severability of Insured's Provision. The Owner shall be exempt from, and in no way liable for, any sums of money which may represent a deductible in any insurance policy. The payment of such deductible shall be the responsibility solely of the Contractor and/or Subcontractor providing such insurance. This insurance shall protect the Contractor from the following claims:

- .1 claims under workers' or workmen compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed;
- .2 claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;

SECTION 008000 – SUPPLEMENTARY GENERAL CONDITIONS (continued)

.4 claims for damages insured by usual personal injury liability coverage including claims which are sustained (1) by a person as a result of an offense directly or indirectly related to employment of such person by the Contractor, or (2) by another person;

.5 claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;

.6 claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle; and

.7 claims involving contractual liability insurance applicable to the Contractor's obligations under Paragraph 3.18.

Delete Subparagraph 11.1.2 and substitute the following:

11.1.2 The insurance required by Subparagraph 11.1.1 provides Coverages, whether written on an occurrence or claims-made basis, that shall be maintained without interruption from date of commencement of the Work until date of final payment and termination of any coverage. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located. Insurance must be maintained for one (1) year after final payment. The insurance required by Subparagraph 11.1.1 shall include contractual liability insurance applicable to the Contractor's obligations under Paragraph 3.18 and coverage for the "XCU" exposure. The amounts set forth herein and by Law shall apply equally or whether on or off the site of the Work.

11.1.2.1 Contractor's Liability: Shall include Comprehensive General Liability, Premises and Completed Operations, Contractual Liability and Broad Form coverage.

- a. Bodily injury in at least the amounts of \$1,000,000 per occurrence, with an Aggregate of \$1,000,000.
- b. Property damage, including Complete Operations and Broad Form: in at least the amount of \$1,000,000 per occurrence, with an Aggregate of \$1,000,000.
- c. Personal Injury (with the employment exclusion deleted) in at least the amounts of \$1,000,000 per occurrence, with an Aggregate of \$1,000,000.

11.1.2.2 Worker's Compensation: The Contractor shall secure and maintain for the life of this Agreement, valid Worker's Compensation Insurance as required by Chapter 440, Florida Statutes. Copies of the insurance policy shall be filed with the Owner no later than 60 days after execution of the Owner-Contractor Agreement. All subcontractors shall maintain valid Worker's Compensation Insurance as required by Florida Statutes.

- a. Applicable Per Florida Statute – Chapter 440
- b. Railroad Required NO
- c. Maritime Required NO
- d. Employer's Liability \$500,000

11.1.2.3 Motor Vehicle Liability (Owned, Non-owned and Hired): The Contractor shall secure and maintain, during the life of this Agreement, Motor Vehicle Liability insurance on all vehicles for the following:

- a. Bodily injury in at least the amounts of \$1,000,000 per occurrence, with an Aggregate of \$1,000,000.
- b. Property damage in at least the amount of \$200,000 per occurrence, with an Aggregate of \$400,000.

11.1.2.4 Owner and Contractor's Protective Liability: The Contractor shall provide an Owner's and Contractor's Protective Liability Policy with the following limits: (A separate policy in the name of the Owner must be provided.)

- a. Bodily injury in at least the amounts of \$1,000,000 per occurrence, with an Aggregate of \$1,000,000.
- b. Property damage in at least the amount of \$1,000,000 per occurrence, with an Aggregate of \$1,000,000.
- c. Personal Injury in at least the amounts of \$1,000,000 per occurrence, with an Aggregate of \$1,000,000.

SECTION 008000 – SUPPLEMENTARY GENERAL CONDITIONS (continued)

- d. Optionally, the Owner may purchase and maintain other insurance for self-protection against claims which may arise from operations under the Contract

11.1.2.5 Public Liability: Shall include Comprehensive General Liability and Products and Completed Operations Liability coverage against bodily injury, personal injury and property damage, in limits as specified.

Delete Subparagraph 11.1.3 and substitute the following:

11.1.3 Two (2) Certificates of Insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. These Certificates and the insurance policies required by this Paragraph 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner; this shall be noted on the Certificates of Insurance. The foregoing insurance coverages are required to remain in force for one (1) year after final payment if written on a claims-made basis; therefore an additional certificate evidencing continuation of such coverage shall be submitted with the final Application for Payment as required by Subparagraph 9.10.2 The Contractor shall furnish one copy each of Certificates of Insurance for each copy of the Agreement which shall specifically set forth evidence of all insurance coverage required by the Contract Documents. The Certificate of Insurance shall be dated and show the name of the insured Contractor, the specific job by name and job number, the name of the insurer, the number of the policy, its effective date, and its termination date. The Contractor shall furnish a copy of the insurance policy to the Owner within 30 days following execution of the Agreement. The Supplemental Attachment form, AIA document G715 shall be completed, signed by the Contractor's insurance representative and attached to the AIA certificate. Furnish to the owner a letter from the insurance company stating that all required insurance has been complied with as specified.

The Supplemental Attachment, The American Institute of Architects' (AIA) Document G715 is included at the end of this section.

Add the following Subparagraph 11.1.4:

11.1.4 The Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the State of Florida, property insurance, written on a Builder's Risk completed value form, in the amount of the initial Contract Sum as well as subsequent modifications thereto for the entire Work at the site, on a replacement cost basis. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Paragraph 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Paragraph 11.1 to be covered, whichever is earlier. This insurance shall include interests of the Owner, the Contractor and Subcontractors in the Work. Perils insured shall be "All Risks" including flood, Earthquake, and Sinkhole. Contractor remains responsible for any deductible under such policy."

Property Insurance coverage shall include coverage of perils of windstorms, fire, lightning vandalism, malicious mischief and those included in extended coverage in the amount of one hundred percent (100%) of the values at risk. Extended coverage, vandalism, and malicious mischief insurance may contain the standard deductibles.

The Owner and Contractor waive all rights against each other for damages caused by fire or other perils to the extent covered by insurance provided under this paragraph, except such rights as they may have to the proceeds of such insurance held by the Owner as trustee. The Contractor shall require similar waivers by Subcontractors and Sub-subcontractors.

Add the following Subparagraphs 11.1.4.1, through 11.1.4.5:

11.1.4.1 Property insurance shall be on a Special Causes of Loss form or its equivalent, including reasonable compensation for the Architect/Engineer's services and expenses required as a result of such insured loss.

11.1.4.2 If the Owner requests in writing that other special insurance be included in the property insurance policy, the Contractor shall, if possible, include such insurance, and the cost thereof shall be charged to the Owner by appropriate Change Order.

SECTION 008000 – SUPPLEMENTARY GENERAL CONDITIONS (continued)

11.1.4.3 If the property insurance provides deductibles, the Contractor shall pay costs not covered because of such deductibles.

11.1.4.4 Any insured loss is payable to the Owner as trustee for the insured, as their interest may appear.

11.4.5 Unless otherwise provided in the Contract Documents, property insurance shall cover portions of the Work stored off the site after written approval of the Owner at the value established in the approval, and also portions of the Work in transit.

Add the following Subparagraph 11.1.5:

11.1.5 Boiler and Machinery Insurance: The Contractor shall purchase and maintain an appropriate installation floater which shall specifically cover such insured objects which are subject to the boiler and machinery hazards during installation and until final acceptance by the Owner.

11.3 WAIVERS OF SUBROGATION

Add Subparagraphs 11.3.3 to 11.3.5:

11.3.3 Partial occupancy or use in accordance with Paragraph 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

11.3.4 The Owner and Contractor waive all rights against each other for damages caused by fire or other perils to the extent covered by insurance provided under this paragraph, except such rights as they may have to the proceeds of such insurance held by the Owner as trustee. The Contractor shall require similar waivers by Subcontractors and Sub-subcontractors.

ARTICLE 13 - MISCELLANEOUS PROVISIONS:

13.1 GOVERNING LAW:

13.1 Add the following:

“13.1.1 The Contractor and Subcontractors shall comply with all applicable provisions of the Florida Building Code 2023 (with latest supplements), Florida Fire Prevention Code 2023, applicable portions of the Florida Administrative Code, federal, state, and local law. All limits or standards set forth in this contract to be observed in the performance of the project are minimum requirements and shall not affect the application of more restrictive standards to the performance of the project.”

“13.1.2 The Contractor and Subcontractors shall comply with the Owner’s personnel background check and badging of all on-site personnel. Refer to Section 00 98 00, Background Check.”

ARTICLE 15 - CLAIMS AND DISPUTES:

15.2 INITIAL DECISION:

15.2 Delete Paragraphs in its’ entirety and substitute the following:

“15.2.1 “Any claim, dispute or other matter in question between the Contractor, Subcontractor and the Owner, shall be referred to the Initial Decision Maker (the Architect will serve as the Initial Decision Maker unless otherwise indicated in the agreement), except those relating to artistic effect, and except those which have been waived by the Owner’s acceptance, shall be subject to litigation at instance of the aggrieved party. However, no litigation of any such claim, dispute or other matter may be commenced until the earlier of (1); the date on which the Initial Decision Maker had rendered a written decision, or (2); the tenth (10) day after the parties have presented their evidence to the Initial Decision Maker, or have been given a reasonable opportunity to do so, if the Initial Decision Maker has not rendered his written decision by that date. When such a written decision of the Initial Decision Maker states (1);

SECTION 008000 – SUPPLEMENTARY GENERAL CONDITIONS (continued)

that the decision is final, but subject to appeal, and (2); that any litigation of a dispute or other matter covered by such decisions must be filed before Final Completion by the party making the demand and received the written decision. Failure to commence litigation within said period will result in the Initial Decision Maker's decision becoming final and binding upon the Contractor, Owner and the Subcontractor.”

ARTICLE 17 - EQUAL OPPORTUNITY:

ADD the following Article:

“17.1 The Contractor shall maintain policies of employment compliant with Executive Order #11246 as follows:

17.1.1 Neither the Contractor or any Subcontractors shall discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, or age. Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer, recruitment or advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor and Subcontractors agree to post in conspicuous places, available to employees and applicants of employment, notices setting forth the policies of non-discrimination.

17.1.2 The Contractor and all Subcontractors shall, in all solicitations advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, national, origin, or age”

END OF SECTION 008000

SECTION 008200 – SPECIAL CONDITIONS

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Attachment: Certificate of Substantial Completion Form

Attachment: Certificate of Contract Completion Form

Attachment: Warranty-Guarantee Form

PART I - GENERAL REQUIREMENTS:

These Special Conditions are hereby made a part of every Section of these Specifications and shall be binding upon each Contractor, Subcontractor, and Material Supplier.

ARTICLE 1: PERMITS AND FEES:

- A. Building Permit: A local building permit is required for this project. The Contractor shall obtain and pay for all required approvals and inspections for the building.
- B. Utility service connection fees (if required) and required utility service fees, if any, will be coordinated by the Contractor and paid for by the Owner.
- C. Other Permits and Fees: Other than as noted above, the Contractor shall assist in obtaining and arranging for payment for all other permits, assessments, fees, bonds, and other charges as necessary to perform and complete the work of this contract, including any related inspection fees, in accordance with the contract between the Owner and the Contractor.
- D. The Contractor and Subcontractors will be subject to all applicable County and local Municipal Occupational License Fees and Taxes.

ARTICLE 2: PROJECT SIGNS:

- A. The Contractor will provide the project sign(s) as designed by the Architect and approved by the Owner. The signs will be ONE (1) 4' x 8' professionally painted (or digital printed and mounted) plywood signs indicating the Architect, Contractor and the Owner. Location to be as directed by the Owner's Representative. No other signs or advertising shall be displayed on the premises without the approval of the Owner. This does not exclude the posting of required trade notices and cautionary signage by the Contractor or the Subcontractors. Directional signage indicating construction entrances, contractor parking, and other miscellaneous information shall be provided as required by the Contractor.
- B. See SECTION 01 50 00 – PROJECT SIGN for additional requirements.

SECTION 008200 – SPECIAL CONDITIONS (continued):

ARTICLE 3: LAYOUT OF WORK:

- A. All work, and in particular piping, ducts, conduit, and similar items, shall be neatly and carefully laid out to provide the most useful space utilization and the most orderly appearance. Except as otherwise indicated or directed, piping and similar work shall be installed as close to ceilings and walls as conditions reasonably permit, located to prevent interference with other work or with the use of the spaces in the manner required by the functions of the space as determined by the Construction Manager, Owner and Architect. Valves and clean-outs shall be located in inconspicuous but accessible locations and shall be field verified before proceeding with any work where exposed to view. The Contractor and Subcontractors shall carefully plan the layout and review any questionable installations with the Contractor and the Architect.
- B. Refer to Section 01 31 00, Project Management and Coordination, for required Coordination Drawings.

ARTICLE 4: TEMPORARY FENCING AND SECURITY:

- A. A temporary fencing enclosure will be required for the duration of the construction period. The temporary fencing may need to be modified by the Contractor for the various phases of construction.
- B. The services of a watchman will NOT be provided by the Owner or the Architect. The Contractor shall be responsible for, and make good, any loss due to theft or vandalism during construction for any claim not covered by Builder's Risk Insurance.
- C. Subcontractors shall advise the Contractor and the Architect of any theft or damage which might delay the execution of the Work.
- D. See SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS for additional requirements.

ARTICLE 5: MATERIAL STORAGE:

- A. Each Subcontractor shall provide sufficient protection for his materials and equipment from damages by weather or construction work, or theft. Location shall be coordinated and approved by the Contractor. During progress of work on a daily basis and upon completion of the work, remove all debris and leave the area in a clean and orderly condition.
- B. See SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS for additional requirements.

ARTICLE 6: TEMPORARY TOILET FACILITIES:

- A. The Contractor will obtain and maintain sanitary temporary toilet facilities acceptable to the local Health Department for use by all crew and workmen.
- B. Contractor and Subcontractors will not have access to existing toilet facilities within this facility or the adjacent buildings for the use of his crew and workmen.
- C. See SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS for additional requirements.

ARTICLE 7: USE OF PREMISES, BARRICADES AND PROTECTION:

- A. Subcontractors shall be subject to such rules and regulations for the conduct of the Work as the Contractor, Owner or Architect may establish.
- B. Before entering upon the Work, ascertain from the Contractor, as approved by the Owner and Architect, what entrances, routes, or roadways shall be used for access to the work, and use only the entrance, routes, and roadways designed for movement of personnel, materials, and vehicles to and from the work.
- C. Contractor shall provide and maintain in good repair barricades, fences, overhead protection, guard railings, etc., as required by law or necessary for the protection of the public and personnel engaged in the Work from hazards incidental to this contract. Take reasonable precautions necessary to protect

SECTION 008200 – SPECIAL CONDITIONS (continued):

- Owner's employees, the public, and workmen from injury or damage to vehicles or other property.
- D. Whenever the Contractor intends to depart from the normal work hours, he shall notify the Owner and the Architect at least twenty (20) hours in advance. Failure of the Contractor to give such timely notice may be cause for the Architect to require the removal or uncovering of the Work performed during such time without the knowledge of the Architect but is subject to the approval of the Owner.
 - E. Protect pavement, curbs, and all existing construction and improvements during the course of the Work and repair all parts of same which become damaged. Contractor and each Subcontractor shall be responsible for the necessary cleaning and repairing of adjacent streets and other improvements resulting from his operations.
 - F. Each Contractor and Subcontractor shall be responsible for all damage to the Owner's property and this project due to his operations. Repair or replacement of damaged items shall be to the satisfaction of the Owner and the Architect.
 - G. Provide and maintain proper shoring and bracing for existing underground utilities, sewers, and building foundations, encountered during excavation work to protect them from collapse or movement, or other type of damage until such time as they are removed or repaired, incorporated into the new work, or can be properly backfilled upon completion of new work.
 - H. Maintain clearances adjacent to and in connection with the work performed.
 - I. The Contractor and each Subcontractor shall effectively confine dust, dirt, and noise to the actual construction areas.
 - J. All employees and people on-site shall maintain procedures as stated in the Contractor's safety program.
 - K. Each Subcontractor shall assume full responsibility for the protection and safekeeping of products under his control which are stored on the site. Subcontractors must move any stored products, under Subcontractor's control, which interfere with operations of the Contractor, Owner or other Subcontractors as directed by the Contractor.
 - L. Contractors and Subcontractors must also obtain and pay for use of additional storage or work areas needed for his operations. The Contractor shall receive from each Subcontractor, a receipt of shipment for all materials and equipment stored on-site (or off-site if approved). No materials or equipment shall be removed from the site without the permission of the Contractor and the Owner. No materials may be stored off-site unless approved in writing by the Contractor, Architect and Owner.
 - M. Contractor and each Subcontractor shall not load or permit any part of a structure to be loaded with a weight that will endanger its safety, or the safety of persons or property.
 - N. All employees of the Contractor and Subcontractors shall conduct themselves in a proper manner. Any disruptive behavior by any employee will cause that employee to be barred from the construction site and the Owner's property. The use of AM/FM radios is prohibited. Animals are not allowed on the property.
 - O. All pumping, bailing, or well point equipment necessary to keep excavations and trenches free from the accumulation of water during the entire progress of this work shall be the responsibility of the Contractor performing said excavations and trenches due to their scope of work. Dispose of water in such a manner as will not endanger public health or cause damage or expense to public or private property. Abide by the requirements of any public agencies having jurisdiction.
 - P. Contractor shall prepare a Safety Plan which clearly delineates areas for construction, safety barriers, exits, construction traffic during the various phases of the project prior to initiating construction. Contractor to submit the Plan to the Architect and Owner.

ARTICLE 8: TEMPORARY FIELD OFFICES FACILITIES AND PARKING:

- A. The Contractor, Owner and the Architect will designate an area for construction trailers (if required), equipment and parking for all construction workers. Placement and schedule shall be coordinated with the Contractor.
- B. Contractor shall provide a temporary field office with a meeting room of adequate size, and other temporary buildings as may be necessary for his operations as approved by the Owner. Storage and maintenance facilities shall be as required in accordance with the local Fire Marshall having jurisdiction. The Contractor shall arrange for the temporary electrical service and other utilities in his area for their use.

SECTION 008200 – SPECIAL CONDITIONS (continued):

- C. The Contractor and/or Subcontractors shall maintain his designated space for office and sheds if provided. This includes removal of weeds, debris, and trash. Clean and restore space at completion of the work.
- D. Field offices and sheds shall not be used for living quarters.
- E. Offices and sheds, when provided, shall be of suitable and safe design, maintenance, and appearance. Temporary facilities shall be securely anchored to the ground to resist wind speed at the specific site of construction.

ARTICLE 9: COOPERATION - DISPUTES:

- A. The completion of the Project within the described time is dependent upon the close and active cooperation at all those engaged therein. Therefore, it is expressly understood and agreed that the Contractor and Subcontractors shall lay out and install his work at such time, and in such manner as not to delay or interfere with the carrying forward of the work of others, and as directed by the Contractor.
- B. In the event of any dispute arising as to possible or alleged interference between the various Subcontractors, which may retard the progress of the Work, the same shall be adjusted by the Contractor.

ARTICLE 10: CLEANUP:

- A. Contractor and Subcontractors shall be responsible for clean-up. Each Contractor shall clean their respective work areas on a daily basis as a minimum.

ARTICLE 11: QUALITY CONTROL:

- A. It is the Contractor's and the Subcontractor's responsibility to familiarize himself with all required tolerances and quality assurance clauses, which are a part of the Contract Documents. It is also the Contractor's and the Subcontractor's responsibility to reject or condemn work performed by his forces or the Sub-Subcontractor's forces which does not comply with the requirements set forth in the Contract Documents, or as required by law, codes, etc. NOTE: If a conflict appears between the tolerances and quality assurance of published industry standards and the requirements of the Contract Documents, the Contract Document requirements will govern.
- B. The Owner, Engineer and Architect will conduct periodic observations of the Work as it progresses. Should the Owner, Engineer or the Architect reject any portion of the Work, he will promptly notify the Contractor with a Notice of Non-Conformance/Rejected Work. The Contractor will immediately provide the responsible Subcontractors with a Notice of Non-Conformance/Rejected Work and upon receipt of such notification shall, within 48 hours, inform the Contractor, Owner and Architect of his intended plan of action.
- C. The Contractor and Subcontractors should be aware that no monies will be awarded against defective work until such work is completed in a manner satisfactory to the Owner and Architect. In addition, the A/E, depending on the extent of the rejected work, may decide to withhold additional monies to compensate for the projected cost of repairs.
- D. In the event a Subcontractor fails to cooperate in the coordination program, he will be held responsible for all costs incurred for adjustments to the work of others made necessary to accommodate the uncooperative Contractor's installations.
- E. When a change order request is issued, the affected Subcontractors shall review the Coordination Drawings and bring to the attention of the Contractor any revisions necessary to the work of others not directly affected by the change order.

ARTICLE 12: CHANGES TO THE WORK:

- A. During the course of the Contractor's and Subcontractor's performance of the work necessary to complete the subject Project, certain events may occur which have the effect of changing the conditions under which the work is to be performed as specified and described in the Bidding Documents and/or the nature and extent of the work as specified and described in the Contract

SECTION 008200 – SPECIAL CONDITIONS (continued):

Documents.

- B. The occurrence of such events may cause the Contractor and Subcontractors to incur greater or less cost and expense to perform the work required to complete the subject Project. The Contractor, Subcontractor(s) or the Owner shall respectively be entitled to either an increase or decrease in the Contract Sum, whichever is the case. The changes shall be made as documented in Section 00 70 00, AIA A201 General Conditions and Section 00 80 00 Supplementary General Conditions.

ARTICLE 13: PRIORITY:

- A. In case of close quarters for installation of mechanical and electrical systems, and in the absence of instructions to the contrary, the following order or precedence shall be followed:
 - 1. Special Equipment - Electric Devices
 - 2. Light Fixtures
 - 3. Sheet Metal Duct Work
 - 4. Plumbing Work, including fire protection piping
 - 5. Mechanical Work, including electrical and A/C pipes
 - 6. Electrical Work
 - 7. Control System
- B. After award of contracts and prior to start of construction the Contractor will schedule a meeting with the Contractors responsible for the work items listed above. The purpose of the meeting will be to introduce the coordination program and to determine its implementation in relation to the progress schedule.
- C. At the initial coordination meeting, the Contractor will provide to the HVAC and Electrical Contractors the drawings for the building on ELECTRONIC MEDIA in Autodesk ACAD Architectural Desktop (2023 Version). The Architect will provide the Contractor with the digital files of the building for the Contractor's and Subcontractor's use to prepare Shop Drawings, Coordination Drawings, and As-Built Drawings upon receipt of accepted AIA Documents E203-2013 and G201-2017 Digital Protocol Agreements and the Architect's Digital File Release Forms from all users. The HVAC and Electrical Contractors, with reference and consideration to the structural, mechanical, electrical, fire protection, plumbing, and reflected ceiling plans, shall draw to scale, his proposed installation showing duct sizes, equipment layouts, and dimensions from column lines and from finished floors to bottom of ducts. Ductwork shall be maintained as tight as possible to the underside of floor slabs and/or beams. In congested areas, the HVAC Contractor shall, in addition, prepare drawings in section view. During this phase of the program, it shall be the Electrical Contractor's and the Fire Protection System Contractor's responsibility to furnish the HVAC Contractor with recessed lighting and sprinkler installation and clearance requirements. This information shall be outlined on the drawings by the HVAC Contractor. Also refer to Section 01 31 00, Project Management and Coordination for the required Coordination Drawings.
- D. In the event a Subcontractor fails to cooperate in the coordination program, he will be held responsible for all costs incurred for adjustments to the work of others made necessary to accommodate the uncooperative Contractor's installations.
- E. When a change order request is issued, the affected Subcontractors shall review the Coordination Drawings and bring to the attention of the Contractor any revisions necessary to the work of others not directly affected by the change order.

ARTICLE 14: COOPERATION WITH PUBLIC SERVICE COMPANIES:

- A. Contractors shall notify the appropriate persons within local utilities 48 hours before commencement of any work, to verify location of existing below grade pipes, cables, poles, towers, and right-of-ways that could be hazardous to life, limb, health or property. The Contractors will be held solely responsible for any injury, damage to existing utilities, or damaged property.

ARTICLE 15: SUBSTITUTION OF MATERIALS AND EQUIPMENT:

SECTION 008200 – SPECIAL CONDITIONS (continued):

- A. All bids submitted shall be based on materials, equipment, and apparatus of the quality and make specified. The Architect will include at least three (3) approved manufacturers, as reasonably possible, but the manufacturers shall comply with the basis-of-design specifications. The Bidder's attention is directed to Section 255.04, Florida Statutes, which requires that on public building contracts, Florida products and labor shall be used wherever price and quality are equal. However, Bidders wishing to obtain approval of an article, device, product, material, fixture, form, or type of construction other than specified or shown by name, make, or catalog number, shall make written request to the Architect timed so as to reach the Architect at least seven (7) working days prior to the date of receipt of bids. Such requests shall be accompanied by data supporting the claim to equality or equivalence.
- B. "Or Equal": The Contractor and Subcontractors shall not decide that another product is equal or equivalent to the brand, or model specified. The Architect is solely charged with this responsibility and judgment. Where "or equal" is stated in the Specifications, it is the Architect/Engineer's and not the Contractor's or Subcontractor's decision as to what brands or suppliers qualify as equal, or equivalent, or do not qualify as equal or equivalent.
- C. The Bidder shall submit drawings and other descriptive data of any modification, or items of assemblies, necessary to provide approved compliance with requirements and compatibility with adjacent components.
- D. Approval by the Architect, if given, will be made by Addendum. Said approval will indicate that the additional article, device, product material, fixture, form, or type of construction is approved for use insofar as the requirements of this Project are concerned. However, it is the responsibility of the Contractor to ensure that the approved item meets all requirements of the Contract. Bids shall not be based on assumed acceptance of any item which has not been approved by Addendum or specified herein. If a substitute item is bid without prior written approval, the Architect holds the option to void that bid, or require that the work be incorporated as specified at no additional cost to the Owner or Architect.
- E. Under no circumstance will the Architect/Engineer be required to prove that a product proposed for substitution is, or is not, equal or equivalent quality to the product specified. It is mandatory that the Bidder submit a complete description of the proposed substitute, the name of the material or equipment for which it is to be substituted, drawings, cuts, performance and test data, and any other data, samples or information necessary for a complete evaluation. Insufficient data will not be considered.
- F. Where more than one (1) manufacturer's product is listed, the listing is not necessarily in order of preference, and all will be considered as equally acceptable as long as they meet the design requirements of the Contract Documents and as determined by the Architect/Engineer.
- G. The Contractor shall provide the same guarantee for an approved substitution, if approved, that is originally required for the originally specified product.

ARTICLE 16: FASTENING DEVICES:

- A. All exposed screw and bolt heads in secure spaces throughout the interior of the Project (this specifically excludes mechanical and electrical rooms) shall comply with the following:
 - 1. Any item which requires periodic access for maintenance shall have "spanner-head" fastening devices, or approved equal, which enables removal of the fastener with appropriate special tools.
 - 2. All exposed fastening devices shall be of tamper-proof design, where ever possible, as approved by the Architect/Engineer.
 - 3. All exterior fasteners shall be stainless steel unless otherwise specified by individual Sections.

ARTICLE 17: PROJECT CLOSE-OUT/DOCUMENTS:

- A. The Contractor and each Subcontractor shall be responsible for collecting, identifying, and collating the following materials, as applicable to his portion of the Work, and shall submit the same (in duplicate) to the A/E. The Contractor, shall properly organize the materials from himself and the various Contractors and Subcontractors into hard cover, 3-ring binders, and shall deliver copies of the finished books to the A/E for verification. The Architect/Engineer will deliver the approved copies to

SECTION 008200 – SPECIAL CONDITIONS (continued):

the Owner for approval. This process, together with the As-Built Drawing requirements, must be completed before the Final Certificate for Payment will be issued by the Architect.

- B. INDEXING: All information shall be organized with categories indexed as per the project close-out index. The individual categories shall also be organized and indexed as per Section of the Specifications.
- C. LISTING OF CONTRACTOR AND SUB-CONTRACTORS: The Contractor shall provide a listing of all Sub-Contractors performing work on the site. Required information shall be as follows:
- (Example)
Division 1
GC / Contractor Representative's Name
Company Name
Title
Address
Phone Number
Facsimile Number
- Division 2
Earth Moving and Site Grading
Representative's Name
Title
Company Name
Phone Number
Address
Facsimile Number
- D. CERTIFICATE OF SUBSTANTIAL COMPLETION: The Contractor shall insert, at this point, a copy of the fully executed Certificate of Substantial Completion on the form incorporated in the project documents, as future reference for the Owner.
- E. CERTIFICATE OF STRUCTURES LOCATIONS: The Contractor shall have a state registered surveyor certify, in writing, with seal affixed, that the location of all new structure(s) is in compliance with the Contract Documents.
- F. TESTING, INSPECTIONS AND CERTIFICATE OF OCCUPANCY: The Contractor shall provide copies of all test and balance reports from his Subcontractors as required. (See Division 21 thru 28.) Provide copies of all Certificates of Inspection from controlling authorities for each trade, division, or section of work, as required. Provide a copy of final executed Certificate of Occupancy.
- G. CONSENT OF SURETY: The Contractor and Contractors shall provide a Consent of Surety on A.I.A. Document G707, Latest Edition.
- H. WARRANTY, GUARANTEE AND BONDS:

1. The Contractor and Subcontractors shall, and hereby does guarantee all Work and materials called for in the Contract Documents, including all work performed by the Contractor and his Subcontractors, for a minimum period of one (1) year from the date of Substantial Completion of the building, unless a longer Warranty/Guarantee time is specified by individual Sections.

The Contractor shall provide a listing of all Sub-Contractors performing work on the site. Required information shall be as follows:

(Example)
Division 1
GC / Contractor Representative's Name
Company Name

SECTION 008200 – SPECIAL CONDITIONS (continued):

Title
Address
Phone Number
Facsimile Number
Start and End of Warranty

Division 2
Earth Moving and Site Grading
Representative's Name
Title
Company Name
Phone Number
Address
Facsimile Number
Start and End of Warranty

2. Warranty guarantee and bonds will be as stated in the Contractor's contract.

I. INSTRUCTION/OPERATION MANUALS AND KEYS:

1. Contractor shall provide all equipment diagrams, instruction/operation manuals, wiring diagrams, and pneumatic and/or electrical control diagrams as applicable for each working characteristic of mechanical, electrical, and special equipment furnished under this Contract, and submitted at Substantial Completion.
2. The Contractor and Subcontractors shall provide a competent and experienced person(s) thoroughly familiar with the work, for a reasonable period of time to instruct the Owner's personnel in operation and maintenance of equipment, materials, and control systems. This instruction shall include normal start-up, run, stop, and emergency operations, location and operation of all controls, alarms, and alarm systems.
3. Label turn-over all keys.

J. MAINTENANCE MANUALS AND SPARE PARTS:

(All items in this Section are required prior to issuance of Certificate of Substantial Completion.)

1. Contractor shall provide all instructions and maintenance manuals for products, mechanical, electrical, and special equipment. This instruction shall include tracing the system in the field and on the diagrams in the manuals so that maintenance personnel will be thoroughly familiar with both systems and the data supplied.
2. Contractor shall submit all parts lists, spare parts, tools, fuses, bulbs, and motor listing, containing locations, motor nameplate, rating, and size of overload relay installed.
3. Contractor shall also provide all maintenance letters as listed in the specifications for manufacturer's cleaning procedures, materials and equipment to be used, including instruction as listed above.

K. AS-BUILT DRAWINGS:

1. Final corrected "As-Built" or "Record" drawings shall be complete and accepted by the Architect/Engineer.
2. Refer to Specification 017700 Section 1.05, Record Drawings, for specified process and requirements.

ARTICLE 18: HISTORICAL AND ARCHAEOLOGICAL DATA PRESERVATION:

- A. The Contractor agrees to facilitate the preservation and enhancement of structures and objects of historical, architectural or archaeological significance and when such items are found and/or unearthed during the course of project construction. Any excavation by the Contractor that uncovers an historical

SECTION 008200 – SPECIAL CONDITIONS (continued):

or archaeological artifact shall be immediately reported to the Owner and a representative of the Architect. Construction within the immediate area shall be temporarily halted pending the notification process and further directions issued by the Architect after consultation with the State Historic Preservation Officer (SHPO) for recovery of the items. *See* the National Historic Preservation Act of 1966 (80 Stat 915, 16 U.S.C. § 470) and Executive Order No. 11593 of May 31, 1971.

ARTICLE 19 ENVIRONMENTAL REQUIREMENTS:

- A. Endangered Species. The Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of the Contractor, the Contractor will immediately report this evidence to the Owner and a representative of the Architect. Construction within the affected area shall be temporarily halted pending the notification process and further directions issued by the Architect after consultation with the Florida Fish and Wildlife Conservation Commission.

ARTICLE 20: INDEMNIFICATION:

- A. To be as stated in the Contract between Owner and Contractor.

END OF SECTION 008200

SECTION 008200 – SPECIAL CONDITIONS (continued):

CERTIFICATE OF SUBSTANTIAL COMPLETION

Date: _____ Project No. _____

The work performed under the Contract dated _____
between _____ (the Owner)
and _____ (the Contractor),
for the construction of _____ (Building Name)
was found to be Substantially Completed as of _____ (Date).

The term "Substantial Completion" shall mean that the construction is sufficiently completed in accordance with the Plans and Specifications, as modified in any Change Order agreed to by the parties, so that the Owner can occupy the building and/or utilize the facility/project for the use for which it was intended without hazard to the occupants or to the facility.

A list of items to be completed or corrected is appended hereto. This list may not be exhaustive and the failure to include an item on it does not alter the responsibility of the Contractor or the Contractor to complete all the work in accordance with the Contract Documents, including authorized changes thereto.

The Contractor will complete or correct the work on the list of items appended hereto within fifteen (15) consecutive calendar days from the Date of Substantial Completion.

Owner assumed full possession of the facility above described on _____.

The responsibility of the Contractor to provide utilities, under the Contract Documents shall cease that date and the one-year warranty period or other specified warranty/guarantees so specified shall begin. Insurance coverage shall continue in accordance with provisions as amended in the Contract Documents.

(Architect/Engineer) _____ (Authorized Representative)

(Contractor) _____ (Authorized Representative)

(Owner) _____ (Authorized representative)

SECTION 008200 – SPECIAL CONDITIONS (continued):

CERTIFICATE OF CONTRACT COMPLETION

AGENCY/OWNER: _____

PROJECT: _____

CONTRACTOR: _____

CONTRACT FOR: _____

CONTRACT DATE: _____

CONTRACT AMOUNT: _____

CONTRACTOR'S AFFIDAVIT: _____

I solemnly swear (or affirm): That the work under the above named Contract and all Amendments thereto have been satisfactorily completed; that all amounts payable for materials, labor and other charges against the project will be paid; that no liens have been attached against the project; that no suits are pending by reason of work on the project under the Contract; that all Workers' Compensation Claims are covered by Workers' Compensation Insurance as required by law; and that all public liability claims are covered by insurance.

CONTRACTOR: _____

Signature: _____

Date: _____

Title: _____

(SEAL)

STATE OF _____

COUNTY OF _____

Personally appeared before me this _____ day of _____, _____, known (or made known) to me to be the
(OWNER) OR (PARTNER) _____
of ,
(Corporate Official Title) _____

Contractor(s), who, being by me duly sworn, subscribed to the foregoing affidavit in my presence.
(Notary Public)

(Type Name): _____

My Commission Expires: _____

SECTION 008200 – SPECIAL CONDITIONS (continued):

WARRANTY – GUARANTEE

Submit for each individual Warranty – Guarantee specified in each Section of the Specifications:

Division No.: _____

Section No.: _____

Title No.: _____

TO: (Owner)

RE: (Project Name)

(Contractor's Name): _____
does hereby certify to all guarantees and warranties taking effect on the date of Substantial Completion and shall remain in force as required by the Contract Documents for the Construction of ; and further certifies that all labor, materials, equipment or items necessary to execute said guarantees and warranties shall be furnished at no cost to the Owner for the duration of each guarantee or warranty period.

WARRANTY – GUARANTEE PERIOD:

(Contractor's Name) _____

(Address) _____

By: _____ (type name of signee below)

Title: _____

Sworn to and subscribed before me this

(NOTARIAL SEAL)

_____ day of _____, _____.

Notary Public, State of Florida

My Commission Expires: _____

SECTION 011000 - SUMMARY OF WORK

PART 1 - GENERAL

1.01 **RELATED DOCUMENTS:** Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.02 **PROJECT DESCRIPTION**

- A. The **Public Works, Hurricane Safe Room** project consists of approximately 2,870 S.F. of Remodeling construction as indicated on drawings.
1. **Project Location:** 200 N Gulf Blvd, Panama City Beach, FL 32413
 2. **Owner:** City of Panama City Beach
- B. **Contract Documents** dated August 7, 2023 were prepared for the Project by Clemons, Rutherford & Associates, Inc., 949 Jenks Ave, Suite 12, Panama City, FL 32401.
- C. **The work** consists of:
1. New mechanical, electrical and plumbing systems.
 2. New interior partitions, doors, windows and finishes.
 3. New CMU exterior walls.
 4. New metal roofing.
 5. New sidewalks.
 6. New site work.
 7. A Hurricane Safe Building Envelope
- D. **Work Sequence:** The work will be conducted in such a sequence to minimize interference to Owner's normal activities.
- E. **Applicable Codes:** All work shall be completed in accordance with the following codes where applicable:
- | | | |
|----|--|----------------|
| 1. | Florida Building Code, Building (FBC,B) | (2023 Edition) |
| 2. | Florida Building Code, Accessibility (FBC,A) | (2023 Edition) |
| 3. | Florida Building Code, Mechanical (FBC,M) | (2023 Edition) |
| 4. | Florida Building Code, Fuel Gas (FBC,FG) | (2023 Edition) |
| 5. | Florida Building Code, Plumbing (FBC,P) | (2023 Edition) |
| 6. | Florida Fire Prevention Code (FFPC) | (2023 Edition) |
| 7. | National Electric Code (NEC) | (2020 Edition) |
| 8. | NFPA 101 | (2021 Edition) |
| 9. | ICC 500 | (2023 Edition) |
- F. **Product Approval:** The Contractor shall, for each product installed in the building envelope, either; provide the applicable Product Approval Numbers OR provide certification (for alternate means of Building code approval) that products installed conform to the Florida Building Code 2023 EDITION. The list of products is as follows:
1. Exterior doors.
 2. Windows.
 3. Roofing products.
 4. Structural components.
 5. Other products as applicable.
- Note: The list shown above is not comprehensive. No effort was made to list each and every possible aperture in the building envelope. The Contractor shall determine what products apply and furnish the applicable Product Approval Numbers, or the required testing and subsequent certifications to meet the Florida Building Code. The Product Approval List can be found within the Florida Building Code website.**

SECTION 011000 - SUMMARY OF WORK (continued):

The following function and performance characteristics shall be provided on the *label* for each *impact-protective system* tested to be installed in the Building envelope:

1. Manufacturer's identification reference or listing number for the assembly
2. Type of *impact-protective system*, such as window assembly, door assembly, shutter assembly or louver.
3. Hazard: hurricane.
4. Missile weight and speed.
5. *Design wind pressure*.
6. Edition of ICC 500.

- G. Contractor: Construction Manager has been engaged for this project to serve as Contractor who in turn Subcontracts all or portions of the work. In Divisions 1 through 33, the terms "Construction Manager" and "Contractor" are synonymous.

1.03 CONTRACTOR USE OF PREMISES

- A. General: During the construction period, the contractor shall have use of the premises for construction activities in areas indicated or agreed upon by the Owner.
1. Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
 2. Contractor to note/delineate any wetlands and protect them during construction. The Owner is to be held harmless if subcontractors invade this area.
 3. Keep surrounding driveways, sidewalks, and entrances serving the site clear and available to the Owner and Visitors at all times. Do not use these areas for parking or storage of materials.
- B. Construction Safeguards: The contractor shall construct safeguards to protect personnel and visitors from the construction areas and areas where materials are stored. Limits of the construction safeguards shall be determined by the Owner.

- 1.04 DRESS CODE AND CONDUCT: All workmen on the construction site shall always wear a shirt. No workmen shall engage in any verbal expressions or physical gestures directed towards any visitors, employees of Owner, or any other person at this construction site which may be considered sexual harassment. All workers are always to be badged. There is no smoking on any part of the property. Any person not meeting these standards will be banned from this construction site.

PART 2 - PRODUCTS (Not applicable).

PART 3 - EXECUTION

- 3.01 LAYOUT OF THE WORK: Dimensions and elevations indicated on the drawings shall be verified by the Contractor prior to commencement of work. Discrepancies between drawings, specifications, and existing conditions shall be referred to the Architect for adjustment before affected work is performed. Failure to make such notification shall place responsibility upon the Contractor to carry out the work in a satisfactory and workmanlike manner at no additional cost to the Owner.

3.02 RESTORATION

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work and do not disturb any plumbing, steam, gas or electric work without approval.
- B. Existing work (mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work. Existing work to be altered or extended and that is found to be defective in

SECTION 011000 - SUMMARY OF WORK (continued):

any way, shall be reported to Architect before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.

- C. Upon completion of contract, deliver work complete and undamaged. Damage that may be caused by Contractor or his workmen to existing structures, grounds, and utilities or work done by others shall be repaired by him at no additional cost to the Owner and left in as good condition as existed prior to damaging.
- D. At his own expense, Contractor shall immediately restore to service and repair any damage he may cause to existing piping and conduits, wires, cables, fiber, etc., of utility services or of fire protection systems and communications systems which are not scheduled for discontinuance or abandonment. Contractor shall employ appropriate parties for repair work.

3.03 CLEANING UP

- A. At completion of the work, the Contractor shall remove from the building and site all tools, appliances, surplus materials, debris, temporary structures and facilities, scaffolding, and equipment; sweep clean the building thoroughly and remove all marks, stains, fingerprints, dust, dirt, paint drippings, and the like from all surfaces; clean tile work, windows, plumbing, and other fixtures and surfaces.
- B. All hardware and other unpainted metals shall be cleaned and polished, and all equipment and paint or decorated work shall be cleaned and touched up, if necessary. Surfaces that are waxed shall be polished. Remove all temporary labels, tags, and paper covering throughout the building.
- C. The exterior of the buildings, the grounds, approaches, equipment, pavement, sidewalks, etc., shall be cleaned similar to interior of buildings and left in good order at the time of final acceptance, with paint surfaces clean and unbroken, hardware clean and polished, all repair work accomplished and dirt areas scraped and cleared of weed growth.
- D. Cleaning, polishing, sealing, waxing, and all other finish operations indicated on the drawings, or required in the specifications, shall mean that this is the required condition at the time of acceptance of all work under the contract.

END OF SECTION 011000

SECTION 012150 - THRESHOLD INSPECTION PLAN

PART 1 - GENERAL

1.01 GENERAL

Florida Statute 553.79 requires that Threshold Buildings have Structural Inspection Plan submitted to the local enforcing agency. As the Engineer of Record, I have prepared the following plan for the Panama City Beach, Public Works Building-Safe Room. The Safe Room has been designed in accordance with the 2023 Florida Building Code, ICC 500-2023, and FEMA P-361 (2024).

1.02 BUILDINGS DESIGNATED AS A THRESHOLD BUILDINGS

Public Works-Safe Room is designated as a Threshold Building.

1.03 SPECIAL INSPECTOR QUALIFICATIONS

The special Inspector shall be a person, not a firm or company, nor two or more persons taken collectively, certified by either the Board of Architecture or the Board of Professional Engineers. The name of the special inspector must be submitted to, and approved by, the Building Official prior to commencement of inspection services.

The special inspector may employ duly authorized technical representatives in the field. However, such representatives must have the following minimum qualifications:

- A. Be a licensed architect or professional engineer, or
- B. Graduate from an engineering education program in civil or structural engineering, or
- C. Graduate from an architectural education program, or
- D. Successfully complete an NCEES examination, or
- E. Be registered as either a building inspector or a general contractor.

SECTION 012150 - THRESHOLD INSPECTION PLAN (continued)

PART 2 - STRUCTURAL INSPECTION PLAN

2.01 SPECIAL INSPECTOR'S RESPONSIBILITY:

The Special Inspector is responsible to the Enforcement Agency having jurisdiction for this Project. The Special Inspector shall not assume the duties of the Enforcement Agency, the Contractor, the Architect, nor the Structural Engineer. The Special Inspector shall make inspections of the construction only to verify that construction is accomplished according to the requirements indicated on the plans and approved specifications. However, the Special Inspector shall not make design decisions, interpretations of the Contract Documents, direct Contractor's work, nor be responsible for construction means and methods. The Special Inspector shall not have the authority to order any changes in the work nor any additional testing, as only the Architect/Engineers of record have such authority. The Special Inspector shall make inspections of all construction indicated on the Structural Drawings and shall immediately report observed construction variations to the Contractor and the Structural Engineer. The Special Inspector, or his duly authorized representatives, shall perform inspections according to the special inspection plan approved by the **Building Official**. The Special Inspector shall prepare written Inspection Reports recording work progress, working conditions, inspection observations, testing, variations of construction from the drawings, requirements pertaining to variations, and corrective actions taken by the Contractor. Since the Special Inspector does not certify that the official Contract Documents are in compliance with the Building Code, all inspections and reports will refer to completed work being in accordance with the Contract Documents rather than the applicable codes. A written inspection report shall be prepared for every inspection performed by the Special Inspector, or his authorized representatives, and all inspection reports shall be signed, dated and bear the impressed seal of the Special Inspector. An updated file summary, and the written reports for all inspections performed during the period shall be submitted to the Enforcement Agency, the Contractor, the Architect, and the Structural Engineer on a weekly basis no more than 3 days after the end of a given weekly period. All inspection reports shall be sequentially numbered and shall indicate:

1. Sequential report number.
2. The date and time of inspection.
3. Identification of the project, the project location, the Contractor and the Owner.
4. Work conditions including weather conditions observed at the time of inspection.
5. The names and affiliation of people pertinent to the project, on the project site at the time of the inspection. Include the name of the person making the inspection,

SECTION 012150 - THRESHOLD INSPECTION PLAN (continued)

names of representatives of the contractor and other pertinent personnel.

6. A summary of the inspection report.
7. Individual inspection observations indicated on a numbered item basis, including, if pertinent, references to previous inspection observations noting previous inspection report numbers and observation item numbers.

Prior to commencement of the inspection services described herein, the special inspector shall issue to the owner a letter stating that he or she has read the special inspection plan and intends to comply with and enforce it. This letter shall bear the special inspectors seal and signature.

2.02 INSPECTION OBSERVATIONS SHALL INCLUDE:

1. Summary of work progress.
2. Testing, including description and locations of testing, test results and requirements pertaining to testing.
3. The construction item or method inspected as indicated on the plans and herein.
4. An indication that the construction item or method observed conforms with or varies from the requirements indicated on the plans.
5. Requirements pertaining to variations including a record of communications between the field inspector and the Structural Engineer.
6. Corrective actions taken by the Contractor including references to the construction item number and the inspection report number where the variation was noted.

2.03 THE SPECIAL INSPECTOR SHALL MAINTAIN AN EXCEPTION FILE RECORDING:

1. Observed variations of construction from the requirements indicated on the drawings including the Inspection report number and construction observation item number recording the observed variation.
2. Requirements indicated either on the drawings or by the Structural Engineer pertaining to variations including the inspection report number and construction observation item number recording these requirements and communication with

SECTION 012150 - THRESHOLD INSPECTION PLAN (continued)

the Structural Engineer.

3. Corrective actions taken including the inspection report number and construction observation item number recording the corrective action.

2.04 OBSERVED CONSTRUCTION VARIATIONS THAT SHALL BE REPORTED TO THE CONTRACTOR, THE ENFORCEMENT AGENCY, THE ARCHITECT AND THE STRUCTURAL ENGINEER INCLUDE, BUT ARE NOT LIMITED TO, THE FOLLOWING:

1. The use of materials, tests, equipment or workmanship not conforming to the drawings.
2. Construction not in substantial conformance with the drawings.
3. Construction without inspection where inspection is prevented due to concealment or other reasons.

2.05 OTHER REQUIREMENTS

The Special Inspector shall insure that all shoring plans are filed with the Building Official prior to commencement of all such activities.

2.06 SPECIAL INSPECTOR'S RESPONSIBILITY TO THE OWNER

The Special Inspector works for and reports directly to the Enforcement Agency but is paid by the owner.

PART 3 - STRUCTURAL INSPECTION STAGES

3.01 SOIL PREPARATIONS

The Special Inspector shall be furnished with a test report from a licensed Geotechnical Engineer in the State of Florida, that has been chosen by the contractor. This report shall verify the bearing capacity and adequacy of the soil to meet and or exceed the requirements stated in the general structural notes.

3.02 FOUNDATIONS

The Special Inspector shall observe and inspect foundations for conformance with the Contract Documents as follows:

SECTION 012150 - THRESHOLD INSPECTION PLAN (continued)

1. Review test reports from concrete testing to verify concrete strength.
2. Check dimensions of foundations including width, length and depth.
3. Verify reinforcing steel grade, size, number of bars, placement, clearance, dowels and splices.
4. Review concrete forming and operations as indicated for concrete inspection herein.

3.03 MASONRY WALLS

The Special Inspector shall observe grouting operations, including grouting filled cells and bond beams, and construction of masonry walls for conformance with the Contract Documents as follows:

1. Masonry units; mortar materials and preparation; joint reinforcing materials, laps and use of preformed corner and tees; dovetail slots; materials and construction.
2. All masonry cells and bond beams to be grouted including cell sizes; clean-out sizes and locations; debris and mortar fin removal; and height of grouting operation.
3. Filled cell, pier and bond beam reinforcing steel, bar conditions, placement, locations, supports and cover, bar sizes, bends and grades; corner bars; and lap splices.
4. Filled cell and bond beam grouting. For masonry grout used to fill cells and bond beams, verify the grout materials and mix. Record all testing. Observe methods used to transport, handle, place, vibrate and consolidate the grout.
5. Tie Beam size and reinforcing.

3.04 CAST-IN-PLACE CONCRETE

The Special Inspector shall inspect the cast-in-place stairs, columns, walls, slabs, and other cast-in-place concrete work for conformance with the Contract Documents as follows:

1. Observe formwork including bulkheads and construction joints and keyways.

SECTION 012150 - THRESHOLD INSPECTION PLAN (continued)

2. Inspect reinforcing steel bar conditions, placements, locations, supports and covers; bar sizes, bends and grades; and lap splices.
3. Inspect embedded items including weld plates, anchor bolts, inserts and sleeves for proper embedment, location and position.
4. Observe and record openings not shown in the drawings and verify added reinforcing or other requirements.
5. Observe and record concrete placement; verify the concrete mix; batching, travel and arrival time and the addition of water to concrete from the batch plant ticket for every batch of concrete. Record all concrete testing including slump tests and test cylinder preparation. Observe methods used to transport, handle, place, vibrate, and consolidate the concrete. Observe curing of concrete. Verify testing required by the Contract Documents is performed.
6. Generally inspect anchors for proper number, sizes, location and tightening.
7. Verify size of all cast-in place concrete elements, including beams, columns, slabs, walls, footings, etc.
8. Receive and review lab reports for strength of concrete.

3.05 STRUCTURAL STEEL

1. Inspect materials for proper size, condition, finish, grade and fabrication including cutting, notching, camber and holes.
2. Inspect erection for location, level, plumb, straightness, finish and fit.
3. Generally inspect bolted connections for proper number, types, sizes and tightening of bolts.
4. Make a visual inspection of all welds for type, length, size and quality of weld. Verify welders on site making field welds have current certificates.
5. Inspect headed stud anchors for size, length, spacing and welding.
6. Inspect steel decks for type, gage, size, condition, welding, side lap connections, laps, connection to supporting structure and weld repair for conformance with Contract Documents. Where steel deck is connected to light gage steel trusses or framing, inspect the screw size and pattern for conformance with Contract

SECTION 012150 - THRESHOLD INSPECTION PLAN (continued)

Documents.

7. Verify testing and secondary inspections required by the Contract Documents are performed.
8. Inspect steel beams to verify that all required bridging and bracing at steel beams, trusses, joists and other elements is in place.
9. Inspect steel bearing on masonry to ensure connection is solid and smooth.

3.09 LIGHT GAGE STEEL ROOF TRUSSES

1. Inspect materials for proper size, condition, grade and fabrication including cutting, splices and connections.
2. Inspect erection for location, plumb, and fit.
3. Inspect layout to confirm actual layout is in accordance with layout plan and mark number locations indicated on vendor drawings.
4. Generally inspect bolted connections for proper number, types, sizes and tightening of bolts.
5. Inspect connection of trusses to walls and beams to verify connection conforms to approved documents.

3.10 STANDING SEAM METAL DECK

1. Inspect materials for proper size, thickness and grade.
2. Inspect joints and attachment clips to insure correct size, type and spacing and overall conformance with vendor drawings and details.

PART 4 - FINAL REPORT

The Special Inspector shall, upon completion of the building and prior to the Issuance of a Certificate of Occupancy, file a signed and sealed statement with the Enforcement Agency, in substantially the following form "To the best of my knowledge and belief, the construction of all structural load-bearing components described in the special inspection plan complies with the approved documents, and the specialty shoring design professional engineer has ascertained that the shoring and reshoring conforms with the shoring and reshoring plans submitted to the

Project Panama City Public Works-Safe Room

012150-7

Phase 1

Date 5/1/2026

SECTION 012150 - THRESHOLD INSPECTION PLAN (continued)

Building Official”.

JOHNSON & ASSOCIATES ENGINEERING

Bradley B. Johnson, P.E.
Florida Registration No. 52284

SECTION 012500 – SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 **SUBSTITUTIONS**: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions." The following **are not** considered substitutions:

- A. Substitutions requested during the bidding period and accepted prior to award of Contract.
- B. Revisions to Contract Documents requested by the Owner or Architect.
- C. Specified options of products and construction methods included in Contract Documents.
- D. Compliance with governing regulations and orders issued by governing authorities.

1.02 **SUBMITTAL**: Requests for substitution will be considered if received within 30 days after commencement of the Work. Requests received may be considered or rejected at the discretion of the Architect after review. See mechanical and electrical "General Provisions" section for special substitution requirements.

- A. Submit 3 copies of each request for substitution in the form and in accordance with procedures for Change Order proposals.
- B. Identify the product, or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Document compliance with requirements for substitutions, and the following information, as appropriate:
 - 1. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
 - 2. Samples, where applicable or requested.
 - 3. A comparison of significant qualities of the proposed substitution with those specified.
 - 4. A list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will be necessary to accommodate the proposed substitution.
 - 5. A statement indicating the substitution's effect on the Construction Schedule compared to the Schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
 - 6. Cost information, including a proposal of the net change, if any in the Contract Sum.
 - 7. Certification that the substitution is equal-to or better in every respect to that required by Contract Documents, and that it will perform adequately in application indicated. Include Contractor's waiver of rights to additional payment or time that may be necessary because of the substitution's failure to perform adequately.
- C. **Architect's Action**: Within one week of receipt of the request for substitution, the Architect will request additional information necessary for evaluation. Within 2 weeks of receipt of the request, or one week of receipt of additional information, whichever is later, the Architect will notify the Contractor of acceptance or rejection. If a decision on use of a substitute cannot be made within the time allocated, use the product specified. Acceptance will be in the form of a Change Order.

SECTION 012500 – SUBSTITUTION PROCEDURES (continued):

- 1.03 **SUBSTITUTIONS:** The Contractor's substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect; otherwise requests will be returned without action except to record noncompliance with these requirements.
- A. The request is directly related to an "or approved equal" clause or similar language in the Contract Documents.
 - B. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
 - C. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
 - D. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate contractors, and similar considerations.
 - E. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
 - F. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
 - G. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.
- 1.04 The Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

END OF SECTION 012500

SECTION 012900 – PAYMENT PROCEDURES

PART 1 - GENERAL

- 1.01 **SCHEDULE OF VALUES:** Coordinate preparation of the Schedule of Values with the Contractor's Construction Schedule. Correlate line items in the Schedule of Values for each phase with other schedules and forms, including:

Contractor's Construction Schedule.
Application for Payment form.
List of subcontractors.
List of products.
Schedule of submittals.

- A. Submit the Schedule of Values to the Architect and Owner at the earliest date, but no later than 7 days before the date scheduled for submittal of the initial Application for Payment.
- B. **Format and Content:** Use the Project Manual Table of Contents as a guide to establish the format.
Identification: Include the following identification:
Project name and location.
Name of the Architect.
Project number.
Contractor's name and address.
Date of submittal.

Format: Use AIA Document G703 Continuation Sheet.

Break down each Division that is listed in enough detail to facilitate evaluation of Application for Payments. Round amounts off to the nearest dollar; the total shall equal the Contract Sum.

Each item in the Applications for Payment and Continuation Sheet shall be complete including total cost and share of overhead and profit. Temporary facilities and items that are not direct cost of Work-in-place may be shown as separate line items or distributed as general overhead expense.

Update and resubmit the schedule when Change Orders change the Contract Sum.

- C. **Change Management:** Any change in the project's 'schedule of values' line items shall be noted to the architect and owner monthly prior to changing the owner schedule of values via a submitted pay application.
- a. **EXAMPLE:**
- i. *Month 1 - site line item = 1000.00.*
 - ii. *Month 2 – site line item = 1500.00, a 500.00 change has been listed in the schedule of values.*
 - iii. *What is the audit path for the change in scheduled value under the sit line item?*
 1. *Did the owner receive a copy of the paperwork documentation back-up requiring this change (RFI, ASI, RFP)?*
 2. *Did the owner receive a proposal for the change in scope prior to proceeding?*
 3. *Did the owner receive a copy of any subcontractor change issued?*
 4. *Did the owner receive a copy of the change management document indicating the proposed change was accepted by the architect and approved by the owner?*
 5. *What Bid line item did the funding added to site line item come from?*
- b. All these noted audit path requirements may be accomplished in different ways but shall be required (at a minimum) regardless of amount or scope of the change. It shall be agreed upon at the outset of each project how change management will be implemented for each of the various types of changes that may occur. It will be noted in project meeting minutes as to the agreed upon method for change management. Subsequent to

SECTION 012900 – PAYMENT PROCEDURES (continued):

those agreements change management shall be implemented in strict compliance with the agreed upon methodology.

1.02 **APPLICATIONS FOR PAYMENT:** Applications for Payment shall be submitted by the 25th of the month and will be paid by the 10th of the following month. Applications for Payment not received by the 25th of the month will be paid not later than 15 days after the date received. The period covered by each Application for Payment is one month. A retainage of 10% of the amount earned and stored will be withheld from each payment.

- A. **Payment Application Times:** Payment dates are indicated in the Agreement. The period covered by each application is the period indicated.
- B. **Payment Application Forms:** Use AIA Document G 702 and Continuation Sheets G 703, 1992 edition, as the form for the application.
- C. **Application Preparation:** Complete every entry, including notarization and execution by person authorized to sign on behalf of the Contractor. Incomplete applications will be returned without action. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made. Include amounts of Change Orders issued prior to the last day of the period covered by the application.
 - a. The first pay application must mimic the approved Bid for the project, or mimic the project bid for the work.
 - b. Per change management section listed in 1.01C, subsequent pay applications may include changes to various line items within the schedule of values. Changes shall be tracked monthly and documentation provided to ensure a clear auditable trail for the project accounting starting with the Bid and ending with the final pay application on the project.
 - c. Each successive pay application must be accompanied by change management paperwork sufficiently detailed to ensure all parties are clear regarding changes or adjustments to the schedule of values.
 - d. It is the sole discretion of the owner to determine what documentation is adequate. However, the minimum required documentation is listed in the change management section herein.
- D. **Transmittal:** Submit 4 executed copies of each application to the Architect within 24 hours; two copies shall be complete, including waivers of lien where required and similar attachments. Transmit each copy with a transmittal listing attachments, and recording information related to the application.
- E. **Waivers of Lien:** With final application, submit waivers of lien from every entity who has performed work, provided labor or supplied materials. Waivers of Lien are to be provided by, but not limited to the following material suppliers and subcontractors. This list is for illustration only, not necessarily complete.

Concrete	Masonry	Paving
Steel	Site Work	Landscaping
Finish Carpentry	Roofing	Doors
Windows	Finish Hardware	Gypsum Wallboard
Flooring	Painting	Ceilings
Signage	Toilet & Bath Accessories	
Mechanical	Plumbing	Electrical

- F. **Waiver Forms:** Submit waivers of lien on AIA Document G706A, "Contractor's Affidavit of Release Of Liens".

SECTION 012900 – PAYMENT PROCEDURES (continued):

- 1.03 **INITIAL APPLICATION FOR PAYMENT:** Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include:

- Fully executed Contract.
- List of subcontractors.
- List of suppliers and fabricators.
- Schedule of Values.
- Contractor's Construction Schedule (preliminary if not final).
- Submittal Schedule (preliminary if not final).
- List of Contractor's staff assignments.
- Copies of building permits (if required).
- Copies of licenses from governing authorities.
- Certificates of insurance and insurance policies.
- Performance and payment bonds.

- 1.04 **PARTIAL RETAINAGE RELEASE**

- A. **FORMS:** Use AIA Document G707A, "Consent of Surety To Reduction in Or Partial Release Of Retainage".
- B. Retainage may only be reduced to 5% with owner approval and in no case will final retainage be released until all items required for final completion are completed and accepted by the architect and the owner.

- 1.05 **APPLICATION FOR PAYMENT AT SUBSTANTIAL COMPLETION:** Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions. Administrative actions and submittals that precede or coincide with this application include:

- Occupancy permits.
- Test/adjust/balance records (Final).
- Operation and Maintenance instructions.
- Meter readings.
- Change-over information related to Owner's occupancy.
- Training as Specified
- Final Cleaning
- As-builts

- 1.06 **BUYOUT SAVINGS AND CONTINGENCY USAGE:** Buy out savings, contingency, and any other project funds are the property of the owner under the control of the Contractor or GC. ALL buy out savings and contingency funds used shall be reported to the owner and may not be used without notification to the owner. See Change management section 1.01C.

- 1.07 **FINAL PAYMENT APPLICATION:** Administrative actions and submittals which must precede or coincide with submittal of the final payment application include:

- Completion of Project closeout requirements. 100% complete to the satisfaction of the Owner and Architect. Refer to Section 01700 - Project Closeout.
- Warranties and maintenance agreements.
- Completion of all items specified for completion after Substantial Completion.
- Transmittal of required Project construction records to Architect.
- AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims".
- Change of door locks to Owner's access.
- AIA Document G707, "Consent of Surety To Final Payment".

END OF SECTION 012900

SECTION 013100 - PROJECT COORDINATION

PART 1 - GENERAL

- 1.01 **THIS SECTION** specifies requirements for project coordination including:

Coordination with other Contractors.	General installation provisions.
Administrative and supervisory personnel.	Cleaning and protection.

- 1.02 **COORDINATION**: Coordinate activities included in various Sections to assure efficient and orderly installation of each component. Coordinate operations included under different Sections that are dependent on each other for proper installation and operation.

Where installation of one component depends on installation of other components before or after its own installation, schedule activities in the sequence required to obtain the best results.

Where space is limited, coordinate installation of different components to assure maximum accessibility for maintenance, service and repair.

Make provisions to accommodate items scheduled for later installation.

Coordinate installations such that items requiring maintenance are readily accessible. Do not block maintenance access to these components with follow on installation. Anything blocked will be corrected by the sub-contractor.

Prepare memoranda for distribution to each party involved outlining required coordination procedures. Include required notices, reports, and attendance at meetings.

Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.

- 1.03 **ADMINISTRATIVE PROCEDURES**: Coordinate scheduling and timing of administrative procedures with other activities to avoid conflicts and ensure orderly progress. Such activities include:

Preparation of schedules.	Delivery and processing of submittals.
Power and utility shutdowns.	Progress meetings.
Installation and removal of temporary facilities.	Project closeout activities.

- 1.04 **COORDINATION DRAWINGS**: Prepare Coordination Drawings where close coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space necessitates maximum utilization of space for efficient installation of different components.

Show relationship of components shown on separate Shop Drawings.
Indicate required installation sequences.

- 1.05 **STAFF NAMES**: Within 10 days of Notice to Proceed, submit a list of Contractor's staff assignments, including Superintendent and personnel at the site; identify individuals, their duties and responsibilities, addresses and telephone numbers. Staff substitutions must be approved by owner in advance.

Post copies in the Project meeting room, the field office, and at each temporary telephone.

- 1.06 **INSPECTION OF CONDITIONS**: The Installer of each component shall inspect the substrate and all other conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected and as follows:

- a. MVER/RH/BNLT moisture readings for slabs on grade or walls must pass manufacturer requirements.
- b. Humidity and temperature control ranges for installation must meet manufacturer requirements.
- c. Other items must meet the listed, installation requirements set forth by the manufacturer.

SECTION 013100 - PROJECT COORDINATION (continued):

- 1.07 **MANUFACTURER'S INSTRUCTIONS:** Comply with manufacturer's installation instructions and recommendations, to the extent that they are more stringent than requirements in Contract Documents.
- 1.08 **INSPECT** material immediately upon delivery and again prior to installation. Reject damaged and defective items.
- 1.09 **PROVIDE ATTACHMENT** and connection devices and methods necessary for securing each construction element. Secure each construction element true to line and level. Allow for expansion and building movement.
- 1.10 **VISUAL EFFECTS:** Provide uniform joint widths in exposed Work. Arrange joints to obtain the best effect. Refer questionable choices to the Architect for decision.
- 1.11 **RECHECK MEASUREMENTS** and dimensions, including elevations, before starting installation.
- 1.12 **INSTALL EACH COMPONENT** during weather conditions and project status that will ensure the best results. Isolate each part from incompatible material as necessary to prevent deterioration.
- 1.13 **COORDINATE TEMPORARY ENCLOSURES** with inspections and tests, to minimize uncovering completed construction for that purpose.
- 1.14 **MOUNTING HEIGHTS:** Where mounting heights are not indicated, install components at standard heights for the application indicated or refer to the Architect.
- 1.15 **CLEANING AND PROTECTION:** During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

Clean and maintain completed construction as often as necessary through the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

Limiting Exposures: Supervise operations to ensure that no part of construction, completed or in progress, is subject to harmful or deleterious exposure. Such exposures include, but are not limited to the following:

- Excessive static or dynamic loading.
- Excessive internal or external pressures.
- Excessive weathering.
- Excessively high or low temperatures or humidity.
- Air contamination or pollution.
- Water or ice.
- Chemicals or solvents.
- Heavy traffic, soiling, staining and corrosion.
- Rodent and insect infestation.
- Unusual wear or other misuse.
- Contact between incompatible materials.
- Theft or vandalism.

END OF SECTION 013100

SECTION 013200 - PROJECT MEETINGS

PART 1 - GENERAL

- 1.01 **SUMMARY:** This Section specifies requirements for Project meetings including:

Pre-Construction Conference.
Progress Meetings.

- 1.02 **PRE-CONSTRUCTION CONFERENCE:** Architect shall conduct a pre-construction conference after execution of the Agreement and prior to commencement of construction activities. Review responsibilities and personnel assignments.

Attendees: The Owner, Architect and their consultants, the Contractor and its superintendent, subcontractors, suppliers, manufacturers, and other concerned parties shall be represented by persons authorized to conclude matters relating to the Work.

Agenda: Discuss significant items that could affect progress, including the tentative construction schedule, critical sequencing, use of the premises, procedures for processing Change Orders and equipment deliveries.

Review progress of other activities and preparations for the activity under consideration at each conference, including time schedules, manufacturer's recommendations, weather limitations, substrate acceptability, compatibility problems and inspection and testing requirements.

Record significant discussions, agreements and disagreements of each conference, along with the approved schedule. Distribute the meeting record to everyone concerned, promptly, including the Owner and Architect.

Do not proceed if the conference cannot be successfully concluded. Initiate necessary actions to resolve impediments and reconvene the conference at the earliest feasible date.

- 1.03 **PROGRESS MEETINGS:** Conduct progress meetings at regular monthly intervals. Notify the Owner and Architect of scheduled dates. Coordinate meeting dates with preparation of the payment request.

Attendees: The Owner and Architect, each subcontractor, supplier or other entity concerned with progress or involved in planning, coordination or performance of future activities shall be represented by persons familiar with the Project and authorized to conclude matters relating to progress.

Agenda: Review minutes of the previous progress meeting. Review significant items that could affect progress. Include topics appropriate to the current status of the Project including:

RFIs
Scheduling

Change Orders
Submittals

Reporting: Distribute copies of the minutes of the meeting to each party present and to parties who should have been present.

- 1.04 **CONTRACTOR'S CONSTRUCTION SCHEDULE:** Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

SECTION 013200 - PROJECT MEETINGS (continued):

Review the present and future needs of each entity present, including such items as:

- Time.
- Sequences.
- Deliveries.
- Off-site fabrication problems.
- Site utilization.
- Temporary facilities and services.
- Hazards and risks.
- Quality and Work standards.
- Change Orders.
- Documentation of information for payment requests.

- 1.05 PROJECT CLOSE OUT MEETING: Once the contractor has gathered a complete project close out deliverable including both hard copies and electronic copies, warranties, extra parts and any other close out required items, they are to notify the architect that they are ready to schedule the project close out meeting.

END OF SECTION 013200

SECTION 013300 - SUBMITTALS

PART 1 - GENERAL

1.01 GENERAL PROCEDURES

- A. Coordinate submittal preparation with performance of construction activities, and with purchasing or fabrication, delivery, other submittals and related activities. Transmit in advance of performance of related activities to avoid delay.
- B. Coordinate transmittal of different submittals for related elements so processing will not be delayed by the need to review concurrently for coordination. The Architect reserves the right to withhold action on a submittal requiring coordination until related submittals are received.

- 1.02 **PROCESSING**: Allow two weeks for initial review. Allow more time if processing must be delayed for coordination with other submittals. The Architect will notify the Contractor when a submittal must be delayed for coordination. Allow two weeks for reprocessing each submittal.

No extension of time will be authorized because of failure to transmit submittals sufficiently in advance of the Work to permit processing.

- 1.03 **SUBMITTAL PREPARATION**: Place a label or title block on each submittal for identification. Provide two 4" x 5" spaces on the label or beside the title block on Shop Drawings to record Contractor's review and approval markings and action taken. Include the following information on the label for processing and recording action taken. Submittals received without a signed Contractor's Approval Stamp will be returned for resubmittal with no action taken.

Project name.

Date.

Name, address and contact info of Contractor.

Name, address and contact info of supplier.

Name and contact info of manufacturer.

Number and title of appropriate Specification Section.

Drawing sheet number and detail references, as required.

- 1.04 **SUBMITTAL TRANSMITTAL**: Package submittals appropriately for transmittal and handling. Transmit with a transmittal form. Submittals received from other than the Contractor will be returned without action.

Transmittal Form: Use AIA Document G 810 or other form acceptable to Architect. On the form record requests for data, and deviations from Contract Documents. Include Contractor's certification that information complies with Contract Documents.

- 1.05 **CONTRACTOR'S CONSTRUCTION SCHEDULE**: Submit a fully developed, CPM type construction schedule with Gantt chart showing critical path and interrelated installations, within 14 days after the date of the Owner's issuance of a Notice to Proceed. Use the categories of work in the schedule to establish the categories in the "Schedule of Values".

As work progresses, mark the schedule to indicate Actual Completion.

Provide notations on the Schedule depicting the consequences on the Work from construction phasing.

Prepare the schedule on sheets of sufficient width to show data for the entire construction period.

Secure commitments for performing critical construction operations from parties involved. Coordinate each activity with other activities and show in proper sequence; include minor elements involved in the construction sequence. Indicate sequences necessary for completion of related portions.

Coordinate the Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests and other schedules.

Schedule completion in advance of the date established for Substantial Completion. Schedule Substantial

SECTION 013300 - SUBMITTALS (continued):

Completion to allow time for the Architect's procedures necessary for certification of Substantial Completion.

Print and distribute schedule following initial approval to the Architect, Owner, subcontractors and other parties required to comply with scheduled dates. Redistribute after any approved revisions. Post copies in the temporary field office. Submit update schedule with each Pay Application.

- 1.06 **DAILY CONSTRUCTION REPORTS:** Prepare a daily construction report, recording information concerning events at the site. Submit duplicate copies to the Architect at weekly intervals. Include the following information:

- List of subcontractors at the site.
- Work Activities.
- High and low temperatures, general weather conditions.
- Accidents, stoppages, delays, shortages, losses.
- Emergency procedures.
- Change Orders received, implemented.
- Partial Completions, occupancies.
- Substantial Completions authorized.
- Other relevant dates.

- 1.07 **SUBMITTALS:** Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 4 sets plus the number of sets required by the Contractor; maximum eight (8) sets. The Architect will retain four sets and return the others marked with the action taken. **(Note: Architect will mark only one (1) set for return to the Contractor with action taken and/or modifications required.)** Maintain Sample sets at the Project site, for quality comparisons throughout construction phase.

Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

- 1.08 **ARCHITECT'S ACTION:** Except for submittals for record, information or similar purposes, where action and return is required, the Architect will review each submittal, mark to indicate action taken, and return. Compliance with specified characteristics is the Contractor's responsibility.

Action Stamp: The Architect will stamp each submittal with a self-explanatory action stamp. The stamp will be appropriately marked to indicate action taken.

- 1.09 **DISTRIBUTION:** Furnish copies of final submittal to installers, and others required for performance of construction activities. Show distribution on transmittal forms. Do not proceed with installation until an applicable copy of Product Data is in the installer's possession. Do not permit use of unmarked copies of Product Data in connection with construction.

- 1.10 **SHOP DRAWINGS:** Submit information, drawn to accurate scale. Submittals shall **indicate deviations from Contract Documents**. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Include the following information:

- Project Name.
- Location.
- Suppliers Name.
- Date.
- Drawing No.
- Specification Section Reference.
- Dimensions.
- Identification of products and materials included.
- Compliance with specific standards.
- Notation of coordination requirements.
- Notation of dimensions established by field measurement.

SECTION 013300 - SUBMITTALS (continued):

Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 24" x 36".

Initial Submittal: Submit one correctable translucent print and two blue-line print for review; the reproducible print will be returned.

Final Submittal: Submit four (4) blue or black line prints of the original submittal for use by the Architect/Engineer, Owner and Contractor.

Do not use Shop Drawings without a Architects stamp indicating action taken in connection with construction.

The Contractor shall schedule all shop drawing submittals to allow sufficient time for one initial review and two resubmittal reviews.

- 1.11 COORDINATION DRAWINGS are a special type of shop drawing depicting relationship and integration of different construction elements requiring coordination during fabrication or installation to fit and function as intended.

Preparation of coordination drawings is described in these Specifications under "Project Coordination" and may include components previously shown on shop drawings or product data.

Submit for integration of different construction elements. Show sequences and relationships of separate components to avoid conflicts in use of space.

- 1.12 PRODUCT DATA: Collect Product Data into a single submittal for each element or system. Mark each copy to show applicable choices and options. Where Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:

Manufacturer's printed recommendations.
Compliance with recognized trade association standards.
Compliance with recognized testing agency standards.
Application of testing agency labels and seals.
Notation of dimensions verified by field measurement.
Notation of coordination requirements.

- A. Paper Submittals: Submit 3 copies. The Architect will retain two and will return the others. **Note:** The Architect will mark only one set for return to the Contractor with action taken and/or modifications required. The Contractor will be responsible to see that any notes made by the Architect are made on all copies.

Unless noncompliance with Contract Documents, the submittal may serve as the final submittal.

- B. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.
- C. Distribution: Furnish copies of final submittal to installers and others required for performance of construction activities. Show distribution on transmittal forms. Do not proceed with installation until an applicable copy of Product Data is in the installer's possession.

- 1.13 SAMPLES: Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics, and a comparison of these characteristics between the final submittal and the component as delivered and installed. Where variations are inherent in the product, submit multiple units that show limits of the variations.

Refer to other Sections for Samples that illustrate details of assembly, fabrication techniques, workmanship, connections, operation and similar characteristics.

SECTION 013300 - SUBMITTALS (continued):

Refer to other Sections for Samples to be returned for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.

Sample sets may be used to obtain final acceptance of the construction associated with each set.

Preliminary submittals: Where Samples are for selection of characteristics from a range of choices, submit a full set of choices for the product. Preliminary submittals will be reviewed and returned indicating selection and other action.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

PART 4 - SCHEDULES

4.01 The following Submittal Schedule is for **REFERENCE ONLY**. Items listed may or may not be required for this project.

SUBMITTAL SCHEDULE		
SECTION	TYPE OF SUBMITTAL	DESCRIPTION
000610 - Performance Bond and Labor and Material Bond	Bonds	Performance Bond, Labor and Material Bond
000430 - List of Subcontractors	List	Subcontractors, Suppliers, Principal Manufactures
012900 - Application for Payment	Schedule of Values Application for Payment	Initial and Subsequent Initial and Subsequent
013100 - Project Coordination	List	Staff Names
013300 - Submittals	Construction Schedule Submittal Schedule Daily Construction Reports	
017700 - Project Closeout	Documents Certificate	Record Drawings, Specifications, Submittals, As-Built, Maintenance Manuals, O & M Instructions OEF Final & Occupancy Inspection
022070 - Selective Demolition	Schedule	Demolition Schedule
313116 - Termite Control	Warranty	Soil Treatment Solution
02510 - Concrete Paving	Shop Drawings	Walkways/Curb Layout
033000 - Concrete	Shop Drawings	Formwork Reinforce Placement/Schedule
042000 - Unit Masonry	Product Data Field Mock-Up	Grout/Mortar, Joint Reinforcement Masonry Wall
042113 - Brick Masonry	Product Data Samples Field Mock-Up	Grout/Mortar, Joint Reinforcement Brick, Mortar Brick Wall
055000 - Metal Fabrication	Product Data Shop Drawings Certification	Assembly and Installation Instructions Metal Fabrication Metal and Steel Test Results
052100 - Metal Building	Shop Drawings	Sizes, Design Information
062000 - Finish Carpentry	Product Data	

SECTION 013300 - SUBMITTALS (continued):

SUBMITTAL SCHEDULE		
SECTION	TYPE OF SUBMITTAL	DESCRIPTION
	Samples	
064023 - Interior Architectural Woodwork	Shop Drawings Samples	Casework Plastic Laminate, Hardware
071326 - Sheet Membrane Waterproofing	Product Data	Technical Data and Recommendations
072116 - Building Insulation	Product Data	Each Type of Insulation Required
076200 - Flashing and Sheet Metal	Product Data Guarantee	Roofing and Flashing Materials Maintenance Guarantee
074113 – Preformed wall and roof panels	Product Data Samples	Manufacturer=s Information
07900 - Joint Sealers	Product Data Samples Certification	Each Type Sealants Product Test Reports
081113 – Hollow Metal Doors and Frames	Shop Drawings Schedules	Frames
081416 - Flush Wood Doors	Product Data Shop Drawings Schedule	Wood Doors
083113 - Access Doors	Product Data	Doors
087100 - Finish Hardware	Schedule Product Hardware	Hardware
088000 - Glass and Glazing	Product Data Samples	Glass/Glazing Materials Glass
093000 - Tile	Product Data Samples	Tile and Grout Tile
095123 - Acoustical Ceilings	Product Data Samples	Panel/Suspension System
09650 - Resilient Flooring	Product Data Sample Maintenance Instructions Replacement Material	Tile and Base
099100 - Painting	Product Data Samples Mock-Up	Paint Paint Field Application
101000 - Markerboards, Chalkboards, Tackboards	Product Data Samples	Each Type of Visual Board Tackboard Fabric
101600 - Toilet Partitions	Product Data Shop Drawings Samples	Toilet Partitions Fabrication of Partitions Color and Solid Plastic Selection
089800 - Louvers and Vents	Product Data Shop Drawings Samples	Louvers and Vents Details Color Selection
104400 - Signage	Product Data Schedule Shop Drawings	Signage Sign Layout
102800 - Toilet and Bath Accessories	Product Data	Accessories

SECTION 013300 - SUBMITTALS (continued):

SUBMITTAL SCHEDULE		
SECTION	TYPE OF SUBMITTAL	DESCRIPTION
109900 - Miscellaneous Specialties	Product Data Shop Drawings	Each Item Installation Instructions Fabrication Details (where required)
111320 - Project Screens and T.V. Mounting Brackets	Product Data Shop Drawings	Screens and Monitor Mounts Installation Details
23010 - Mechanical General Provisions		
22400 - Plumbing		
26010 - Electrical General Provisions		

NOTE: Additional Submittals may be requested by the Architect/Engineer.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

- 1.01 **GENERAL:** This Section specifies requirements for quality control services. Quality control services include inspections and tests performed by independent agencies, governing authorities, as well as the Contractor.
- 1.02 **CONTRACTOR RESPONSIBILITIES:** Provide inspections and tests specified or required by governing authorities, except where they are the Owner's responsibility, or are provided by another entity; services include those specified to be performed by an independent agency not by the Contractor. Costs are included in the Contract.

The Contractor shall engage and pay for services of an independent agency, acceptable to the Architect/Engineer to perform inspections and tests specified as Quality Control services.

Retesting: The Contractor is responsible for retesting where results prove unsatisfactory and do not indicate compliance with Contract Documents, regardless of whether the original test was the Contractor's responsibility.

Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.

Associated Services: The Contractor shall cooperate with agencies performing inspections or tests and provide auxiliary services as requested. Notify the agency in advance of operations to permit assignment of personnel. Auxiliary services include but are not limited to:

Provide access to the Work and furnish incidental labor and facilities necessary to facilitate inspections and tests.

Take representative samples of materials that require testing or assist the agency in taking samples.

Provide facilities for storage and curing of samples and deliver samples to testing laboratories. Provide a preliminary design mix proposed for use for material mixes that require control by the testing agency.

Provide security and protection of samples and test equipment at the Project site.

- 1.03 **CONTRACTOR STATEMENT OF RESPONSIBILITIES (PER ICC 500, SECTION 107):**

Each contractor responsible for the construction, fabrication or installation of a main windforce-resisting system, *impact-protective system* or any component listed in the quality assurance plan shall submit a written statement of responsibility to the *authority having jurisdiction*, the responsible design professional and the owner or the owner's authorized agent prior to the commencement of work on the system or component. See form at the end of this section. The contractor's statement of responsibility shall contain:

1. Acknowledgement of awareness of the special requirements contained in the quality assurance plan.
2. Acknowledgement that control will be exercised to obtain compliance with the construction documents.
3. Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of reports.
4. Identification and qualifications of the person exercising such control and their position in the organization.

Exception: A written statement of responsibility shall not be required for the fabrication of *storm shelter* components that have been inspected and *labeled* by an *approved agency* as meeting the requirements of the *applicable code* and this standard.

- 1.04 **DUTIES OF THE TESTING AGENCY:** The agency engaged to perform inspections and testing of materials and construction shall cooperate with the Architect and Contractor in performance of its duties

SECTION 014000 - QUALITY REQUIREMENTS (continued)

and provide qualified personnel to perform inspections and tests.

The agency shall notify the Architect and Contractor promptly of deficiencies observed during performance of its services.

The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.

- 1.05 **COORDINATION:** The Contractor and each agency engaged to perform inspections and tests shall coordinate the sequence of activities to accommodate services with a minimum of delay. The Contractor and each agency shall coordinate activities to avoid removing and replacing construction to accommodate inspections and tests.

The Contractor is responsible for scheduling inspections, tests, taking samples and similar activities.

- 1.06 **SUBMITTALS:** The testing agency shall submit a certified written report of each inspection and test to the Architect, in duplicate, unless the Contractor is responsible for the service. If the Contractor is responsible, submit a certified written report of each inspection and test through the Contractor, in triplicate, who shall send two (2) copies to the Architect.

Submit additional copies of each report to the governing authority, when the authority so directs.

Report Data: Written reports of each inspection or test shall include, but not be limited to:

Date of issue.
Project title and number.
Name, address and telephone number of testing agency.
Testing agency qualifications.
Dates and locations of samples and tests or inspections.
Names of individuals making the inspection or test.
Designation of the Work and test method including applicable industry standards and/or codes.
Identification of product and Specification Section.
Complete inspection or test data.
Test results and an interpretations of test results.
Ambient conditions at the time of sample-taking and testing.
Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.
Name and signature of laboratory inspector or person reviewing results.
Recommendations on retesting.

- 1.07 **QUALIFICATION FOR SERVICE AGENCIES:** Engage inspection and testing agencies which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories and specialize in the types of inspections and tests to be performed.

Each inspection and testing agency engaged shall be authorized to operate in the State in which the Project is located.

- 1.08 **REPAIR AND PROTECTION:** Upon completion of inspection and testing repair damaged construction and restore substrates and finishes to eliminate deficiencies. Comply with requirements for "Cutting and Patching."

Protect construction exposed by or for quality control service activities and protect repaired construction.

The Contractor is responsible for repair and protection regardless of the assignment of responsibility for inspection and testing.

SECTION 014000 - QUALITY REQUIREMENTS (continued)

Contractor's Statement of Responsibility

Each contractor responsible for the construction or fabrication of a system or component designated in the Quality Assurance and Special (Threshold) Inspection Plan must submit a Statement of Responsibility.

Project: Public Works, Hurricane Safe room

Contractor's Name:

Address:

License No.:

Description of designated building systems and components included in the Statement of Responsibility:

Contractor's Acknowledgment of Special Requirements

I hereby acknowledge that I have received, read, and understand the Quality Assurance and Special (Threshold) Inspection program.

I hereby acknowledge that control will be exercised to obtain conformance with the construction documents approved by the Building Official.

Signature Date

Contractor's Provisions for Quality Control

Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of reports is attached to this Statement.

Identification and qualifications of the person(s) exercising such control and their position(s) in the organization are attached to this Statement.

SECTION 014000 - QUALITY REQUIREMENTS (continued)

END OF SECTION 014000

SECTION 014200 - DEFINITIONS AND STANDARDS

PART 1 - GENERAL

1.01 DEFINITIONS: Basic Contract definitions are included in the General Conditions.6

- A. Indicated refers to graphic representations, notes or schedules on Drawings, or Paragraphs or Schedules in Specifications, and similar requirements in Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help locate the reference.
- B. Directed: Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted" mean "directed by the Architect", "requested by the Architect", and similar phrases. No implied meaning shall be interpreted to extend the Architect's responsibility into the Contractor's supervision of construction.
- C. Approve, used in conjunction with action on submittals, applications, and requests, is limited to the Architect's duties and responsibilities stated in General and Supplementary Conditions. Approval shall not release the Contractor from responsibility to fulfill Contract requirements.
- D. Regulation includes 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, whether lawfully imposed by authorities having jurisdiction or not.
- E. Furnish means "supply and deliver, ready for unloading, unpacking, assembly, installation, and similar operations."
- F. Install describes operations at the site including "unloading, unpacking, assembly, erection, anchoring, applying, working to dimension, protecting, cleaning and similar operations."
- G. Provide means "furnish and install, complete and ready for use."
- H. Installer: "Installer" is the Contractor, or an entity engaged by the Contractor, as an employee, subcontractor or sub- subcontractor for performance of a particular construction activity, including installation, erection, application and similar operations. Installers are required to be experienced in the operations they are engaged to perform. The term "experienced," when used with "Installer" means having a minimum of 5 previous Projects similar in size to this Project, and familiar with the precautions required, and with requirements of the authority having jurisdiction.
- I. Project Site is the space available for construction activities, either exclusively or with others performing other construction on the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land upon which the Project is to be built.
- J. Testing Laboratories: A "testing laboratory" is an independent entity engaged to perform specific inspections or tests, at the Project Site or elsewhere, and to report on, and, if required, to interpret, results of those inspections or tests.

1.02 SPECIFICATION FORMAT: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 48-Division format and MASTERFORMAT 2004 numbering system. Language used in the Specifications is the abbreviated type. Implied words and meanings will be appropriately interpreted. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and where the context so indicates. Imperative language is used generally. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text subjective language is used to describe responsibilities which must be fulfilled indirectly by the Contractor, or by others when so noted. The words "shall be" shall be included by inference wherever a colon (:) is used within a sentence or phrase.

SECTION 014200 - DEFINITIONS AND STANDARDS (continued):

- 1.03 **ASSIGNMENT OF SPECIALISTS:** Certain construction activities shall be performed by specialists, recognized experts in the operations to be performed. Specialists must be engaged for those activities, and assignments are requirements over which the Contractor has no option. Nevertheless, the ultimate responsibility for fulfilling Contract requirements remains with the Contractor.
- 1.04 **DRAWING SYMBOLS:** Where not otherwise noted, symbols are defined by "Architectural Graphic Standards", published by John Wiley & Sons, Inc., eighth edition.
- 1.05 **MECHANICAL/ELECTRICAL DRAWINGS:** Graphic symbols for mechanical and electrical Drawings are defined in a graphic symbol legend on the Construction Documents and are aligned with symbols recommended by ASHRAE. Where appropriate, they are supplemented by symbols recommended by technical associations. Refer instances of uncertainty to the Architect for clarification before proceeding.
- 1.06 **APPLICABILITY OF STANDARDS:** Except where the Contract Documents include more stringent requirements, applicable industry standards have the same force and effect as if bound or copied into Contract Documents. Such standards are part of the Contract Documents by reference. Individual Sections indicate standards the Contractor must keep available at the Project Site.
- 1.07 **PUBLICATION DATES:** Where the date of issue of a referenced standard is not specified, comply with the standard in effect as of date of Contract Documents.

Updated Standards: Submit a Change Order proposal where an applicable standard has been revised and reissued after the date of the Contract Documents and before performance of Work. The Architect will decide whether to issue a Change Order to proceed with the updated standard.

- 1.08 **CONFLICTING REQUIREMENTS:** Where compliance with two or more standards that establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced. Refer uncertainties as to which quality level is more stringent to the Architect for a decision before proceeding.

Minimum Quantities or Quality Levels: The quantity or quality shown or specified is the minimum to be provided or performed. Indicated values are minimum or maximum values, as appropriate for the requirements. Refer instances of uncertainty to the Architect for decision before proceeding.

- 1.09 **COPIES OF STANDARDS:** Each entity engaged on the Project shall be familiar with standards applicable to that activity. Copies of applicable standards are not bound with the Contract Documents.

Where copies of standards are needed for performance of a required construction activity, the Contractor shall obtain copies directly from the publication source.

Although copies of standards needed for enforcement of requirements may be part of submittals, the Architect reserves the right to require submittal of additional copies for enforcement of requirements.

- 1.10 **ABBREVIATIONS AND NAMES:** Where acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction or other entity applicable. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.
- 1.11 **PERMITS, LICENSES, AND CERTIFICATES:** For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES

PART 1 - GENERAL

- 1.01 **RELATED DOCUMENTS:** Drawings and General Provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.
- 1.02 **SUMMARY:** This Section specifies temporary services and facilities, including utilities, construction and support facilities, security and protection. Provide facilities ready for use. Maintain, expand and modify as needed. Remove when no longer needed or replaced by permanent facilities.
- Temporary facilities required include but are not limited to water service and distribution, temporary electric power and light, storage sheds, sanitary facilities and temporary enclosures, barricades, warning signs, lights and environmental protection.
- 1.03 **USE CHARGES:** Cost or use charges for temporary facilities are not chargeable to the Owner or Architect and will not be accepted as a basis of claims for a Change Order.
- 1.04 **REGULATIONS:** Comply with all applicable local, state, and federal laws and regulations.
- 1.05 **STANDARDS:** Comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities" and OSHA.
- A. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", prepared by AGC and ASC.
- B. **Electrical Service:** Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).
- 1.06 **INSPECTIONS:** Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.
- 1.07 **CONDITIONS OF USE:** Keep facilities clean and neat. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload or permit facilities to interfere with progress. Do not allow hazardous, dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.
- 1.08 **MATERIALS AND EQUIPMENT:** Provide new materials and equipment; if acceptable to the Architect, undamaged previously used materials and equipment in serviceable condition may be used. Provide materials and equipment suitable for the use intended.
- A. **Tarpaulins:** Waterproof, fire-resistant, UL labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures provide translucent nylon reinforced laminated polyethylene or polyvinyl chloride fire retardant tarpaulins.
- B. **Temporary / Construction Fencing:** 11-gage, galvanized 2-inch, chain link fabric fencing 6-feet high with galvanized steel pipe posts, 1-1/2" I.D. for line posts and 2-1/2" I.D. for corner posts.
- 1.09 **TEMPORARY UTILITY INSTALLATION:** Engage the local utility company to install temporary service or connect to existing service. Arrange for a time when service can be interrupted to make connections. Provide adequate capacity at each stage of construction. Combined use of temporary and existing power and water is anticipated for this project.
- A. **Water Service:** Install water service and distribution piping of sizes and pressures adequate for construction. Sterilize water piping prior to use.

SECTION 015000 - TEMPORARY FACILITIES (continued):

- B. Electric Power Service:
Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics. Include meters, transformers, overload protected disconnects, automatic ground-fault interrupters and main distribution switch gear. Install service underground, if possible.
1. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage.
 2. Electrical Outlets: Provide properly configured NEMA polarized outlets. Provide outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.
 3. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to traffic.
- C. Lighting: Provide temporary lighting with local switching to fulfill security requirements and provide illumination for construction operations and traffic conditions.
1. Lamps and Light Fixtures: Provide general service incandescent lamps. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- D. Telephones: Provide temporary telephone service for personnel engaged in construction. Post a list of important telephone numbers.
- E. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent. If sewers are not available or cannot be used, provide drainage ditches, or similar facilities.

Filter out construction debris and other contaminants that might clog sewers or pollute waterways before discharge. Provide earthen embankments and similar barriers in and around excavations and subgrade construction to prevent flooding by runoff of storm water from heavy rains.

Comply with all City and County requirements for storm water runoff.

- 1.10 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION: Locate for easy access. Maintain facilities until Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, if acceptable to the Owner.
- A. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads where they do not interfere with construction activities.
 - B. Dust Control: If, in the opinion of the Owner or Architect it is necessary to control dust during construction period, the Contractor shall furnish and spread water or calcium chloride at points where dust is a nuisance or as directed by the Architect, at no additional cost to the Owner.
 - C. Field Office: Provide field offices of size required to accommodate personnel, including telephone and fax line. In addition, provide a 3' x 5' desk, table and stool for use by the Architect. Field office is to be provided with air conditioning. Keep clean and orderly for use for small progress meetings.
 - D. Storage and Fabrication Sheds: Install sheds, equipped to accommodate materials and/or existing equipment involved. Sheds may be open shelters.

SECTION 015000 - TEMPORARY FACILITIES (continued):

- E. Sanitary facilities include temporary toilets and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation and maintenance of fixtures. Install where facilities will best serve the Project. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.
 - F. Toilets: Install self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material. Use of pit-type privies will not be permitted. Under no circumstances will construction personnel use existing toilet facilities.
 - G. Drinking Water Facilities: Provide containerized tap-dispenser type drinking water units.
 - H. Dewatering Facilities and Drains: For temporary drainage and dewatering operations not associated with construction, comply with requirements of applicable Division-2 Sections. Where feasible, utilize the same facilities. Maintain excavations and construction free of water.
 - I. Temporary Enclosures: Provide temporary enclosure for protection of construction from exposure, foul weather, other construction operations and similar activities. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions.

Install tarpaulins securely, with incombustible framing. Close openings through floor or roof decks and horizontal surfaces with load-bearing construction.
 - J. Collection and Disposal of Waste: Collect waste daily. Comply with NFPA 241 for removal of combustible waste. Enforce requirements strictly. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose in a lawful manner.
 - K. Project Identification and Temporary Signs: Prepare project identification signs on grade B-B High Density Overlay Plywood; install where indicated by Architect. Support on framing of preservative treated wood or steel. Engage an experienced sign painter to apply graphics. Refer to project identification sign drawing at end of this section (Attachment 015000-1).
- 1.11 **SECURITY AND PROTECTION FACILITIES INSTALLATION**: Except for use of permanent fire protection as soon as available, do not change from use of temporary security and protection facilities to permanent facilities until Substantial Completion.
- A. Fire Protection: Until fire protection is supplied by permanent facilities, install and maintain temporary fire protection of types needed to protect against predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations." Consideration should be given to existing fire hydrant locations.
 - B. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers. Locate fire extinguishers where effective for the intended purpose.

Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
Store combustible materials in containers in fire-safe locations.
Provide supervision of welding operations, combustion type temporary heating units, and sources of fire ignition.
 - C. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of barricades. Paint appropriate warning signs to inform personnel and the public of the hazard being protected against. Where needed provide lighting, including flashing lights. Temporary, portable or metal barricades and structures shall be constructed over all open trench areas

SECTION 015000 - TEMPORARY FACILITIES (continued):

intersecting student walkways. Walkway structures over trenches shall be of sturdy construction with handrails and be handicap accessible.

- D. Security Enclosure and Lockup: Install temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism and theft. Where materials and equipment must be stored, provide a secure lockup.
 - E. Enclosure Fence: When excavation begins, install an enclosure fence with lockable entrance gates where indicated, or if not indicated, enclose the entire site or the portion sufficient to accommodate operations. Provide open-mesh, chain-link fencing with posts set in a compacted mixture of gravel and earth.
 - F. Environmental Protection: Operate temporary facilities and conduct construction by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted. Restrict use of noise making tools and equipment to hours that will minimize complaints.
- 1.12 OPERATION: Enforce strict discipline in use of temporary facilities. Limit availability to intended use to minimize abuse. Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and the elements.

Maintain operation of enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24-hour day basis to achieve indicated results and to avoid damage.

Prevent piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

- 1.13 TERMINATION AND REMOVAL: Remove each facility when the need has ended, or replaced by a permanent facility, or no later than Substantial Completion. Complete or restore construction delayed because of interference with the facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.

Temporary facilities are property of the Contractor.

At Substantial Completion, renovate permanent facilities used during the construction period, including but not limited to:

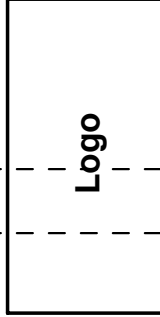
Replace air filters and clean inside of ductwork and housings.
Replace worn parts and parts subject to unusual operating conditions.
Replace burned out lamps.

END OF SECTION 015000

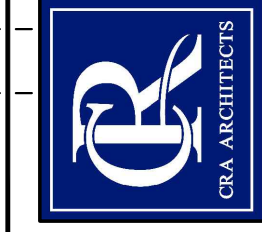


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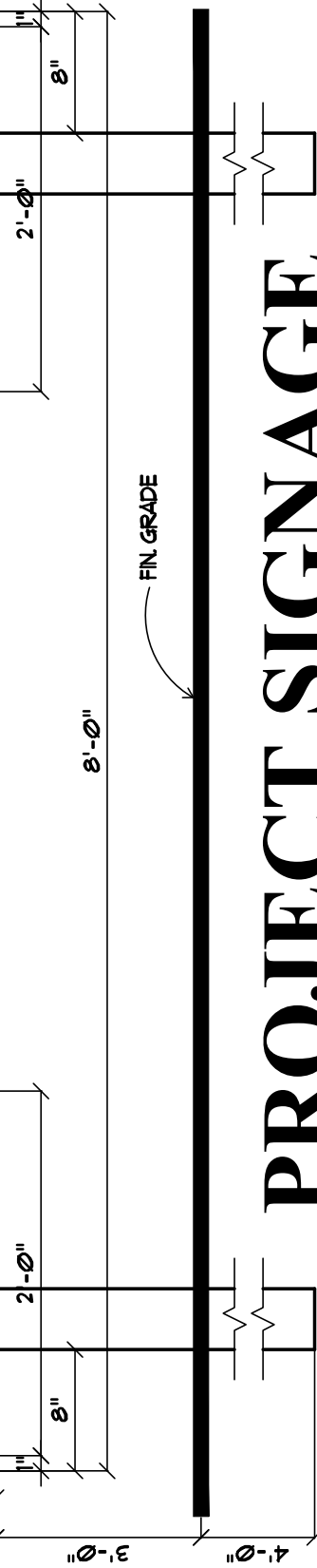


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PROJECT SIGNAGE



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(850) 385-6153 Fax (850) 386-8420

NOTES:

1. LETTERING STYLES SHALL BE ARIAL, UNLESS NOTED OTHERWISE.
2. ALL COLORS ARE TO BE SELECTED BY THE ARCHITECT
3. PLYWOOD SHALL BE 3/4" MDO EXTERIOR GRADE
4. CONTRACTOR SHALL FINISH SIGN
5. PROVIDE SHOP DRAWING LAYOUT FOR ARCHITECTS' REVIEW PRIOR TO PAINTING SIGN
6. ARCHITECT TO SELECT LOCATION OF SIGN

NOTE:

CONTRACTOR AND / OR SIGN
SHOP TO CONTACT CRA
TO REQUEST AN ELECTRONIC
COPY OF IMAGE PRIOR
TO PRINTING.

FINISH:

ALKYD PRIMER & INDUSTRIAL
ENAMEL PANELS ARE PAINTED
ON BOTH SIDES & ALL EDGES.
FINISH COAT ON FACE SIDE IS
DOUBLED COATED.

COLORS:

GRAY BACKGROUND
(FMS 1541U)
NAVY BLUE LOGO &
LETTERING (FMS 2161U)

SECTION 015500 - MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.01 DEFINITIONS

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.
- B. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
- C. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature that is current as of the date of the Contract Documents.
- D. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
- E. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.02 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
- B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
- C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturers or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.
- D. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
- E. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:

Name of product and manufacturer.

Model and serial number.

Capacity.

Speed.

Ratings.

SECTION 015500 - MATERIALS AND EQUIPMENT (continued):

- F. Field marking for electrical, mechanical, plumbing and telecom locations:
1. All above ceiling electrical, mechanical, and plumbing shall have below ceiling labeling provided for some specific items IFF located above ceiling.
 - a. Electrical – any electrically powered motor or device other than junction boxes located in a concealed location above ceiling shall be labeled below ceiling. See labeling requirements in a separate section “Labeling”.
 - b. HVAC – HVAC equipment located above ceiling including but not limited to VAV, VRF, AHU, EF units, and valves shall be baled below ceiling so as to make them easily locatable from below ceiling. Identification should match plan call outs for the items such that plans may be utilized in conjunction with labeling to locate and maintain each item.
 - c. Plumbing – all valves located above ceiling shall be labeled below ceiling. Above ceiling valve shall be marked with permanently affixed TAG indicating what areas or items are served by the valve.
 - d. Telecomm – see above ceiling labeling requirements per specification section on telecomm devices. Any signal repeaters, or other data / telecomm equipment located above ceiling shall be labeled on the ceiling below for easy identification in the future.
 2. Labels shall be 1” x 4” in size and permanently attached to underside of drywall or permanently affixed to the acoustic ceiling grid within 2 feet of the above ceiling item being labeled.
 3. Labels shall be hard plastic.
 4. Lettering shall be minimum 12 font engraved into labels.
 5. Color coding of labels shall be as follows:
 - a. Red = electrical & Fire
 - b. Yellow = gas
 - c. Blue = water & sewer
 - d. Green = HVAC
 - e. Orange – telecomm
 - f. ***Other colors as mutually agreed by owner and architect to be added***

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
- B. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses; and to prevent overcrowding of construction spaces.
- C. Deliver products to the site in undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
- D. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- E. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
- F. All new installed materials shall be sealed from moisture penetration at the end of each day.

SECTION 015500 - MATERIALS AND EQUIPMENT (continued):

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION

- A. **General Product Requirements:** Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation. Discontinued items will not be accepted.
1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
 2. **Standard Products:** Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. **Product Selection Procedures:** The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:
1. **Semi proprietary Specification Requirements:** Where Specifications name two or more products or manufacturers, provide one of the products indicated.

Where Specifications specify products or manufacturers by name, accompanied by the term "**or equal**" or "**or approved equal**", comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
 2. **Descriptive Specification Requirements:** Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
 3. **Performance Specification Requirements:** Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by the manufacturer for the application indicated.

Manufacturer's recommendations may be contained in published product literature or by the manufacturer's certification of performance.
 4. **Compliance with Standards, Codes, and Regulations:** Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.
 5. **Visual Matching:** Where Specifications require matching an established Sample (match existing), the Architect's decision will be final on whether a proposed product matches satisfactorily.

Where no product is available within the specified category, matches satisfactorily and complies with other specified requirements; comply with provisions of the Contract Documents concerning "substitutions" (Section 01631 - Product Substitutions) for selection of a matching product in another product category.
 6. **Visual Selection:** Where specified product requirements include the phrase "... as selected from manufacturer's standard colors, patterns, textures ..." or a similar phrase, select a product and manufacturer that complies with specified requirements. The Architect will select the color, pattern, and texture from the product line selected. Any selections within the product line which are unavailable, no longer make or superseded by another should be so marked.

SECTION 015500 - MATERIALS AND EQUIPMENT (continued):

PART 3 - EXECUTION

3.01 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
- B. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 015500

SECTION 017700 – CLOSEOUT PROCEDURES

PART 1 - GENERAL

- 1.01 **SUBSTANTIAL COMPLETION:** (See Section 00700 - General Conditions, Section 9.8). Before requesting inspection for certification of Substantial Completion, complete the following:
- A. Change-over permanent locks and transmit keys to the Owner.
 - B. Complete start-up testing of systems, and instruction of the Owner's personnel. Remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
 - C. Complete final clean up. Touch-up and repair and restore marred exposed finishes.
 - D. Submit record drawings (As-builts), maintenance manuals, damage or settlement survey, and similar record information.
 - E. Attain Occupancy permits.
- 1.02 **INSPECTION PROCEDURES:** When the Contractor considers the work substantially complete, he shall prepare and submit a comprehensive list of items to be completed and/or corrected to the Architect. The Contractor shall proceed to promptly complete and/or correct all items on the list.
- A. Upon receipt of Contractor's list and assurance by the Contractor that the list has been addressed/ completed, the Architect will make an inspection for final verification that the list provided is comprehensive and includes all remaining work items to be completed or corrections required OR inform the Contractor of work to be completed before an inspection will be conducted.
 - B. After receipt of the completion/punch list and prior to the architect issuing substantial completion, the architect shall require that every consultant who provided documents for the project (ie: electrical, HVAC, Plumbing, Architectural, Roof, telecomm, etc.) shall perform an onsite inspection of work completed under the scope of their responsibilities and provide a detailed final completion list of incomplete work or work requiring corrections.
 - C. This process will be the responsibility of the Architect to ensure this occurs and that the information gathered from those site visits is to be coordinated through the contractor, added to the contractor's final completion/punch list, and issued to the owner. This will ensure that all required corrections are included in the final punch list prior to substantial completion being awarded.
 - D. When the work is substantially complete, the Architect will prepare the Certificate of Substantial Completion which shall establish the date of Substantial Completion.
 - E. Results of the completed inspection will form the basis of requirements for final acceptance, **including any items discovered at a later date considered necessary to be completed for final.**
- 1.03 **FINAL ACCEPTANCE:** (See Section 00700 - General Conditions Section 9.10). Before requesting inspection for certification of final acceptance and final payment, complete the following:
- A. Submit a copy of the final inspection list stating that each item has been completed or otherwise resolved for acceptance.
 - B. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
 - C. Refer to Section 01027 - Application for Payment - Final Payment Application.
 - D. Provide the Architect with 'Final Statement of Compliance', for the Owner.

SECTION 017700 – CLOSEOUT PROCEDURES (continued):

- 1.04 **REINSPECTION PROCEDURE** (if required): The Architect will reinspect the Work upon receipt of notice that the Work has been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect.
- A. Prior to Final completion, A Final walk through/verification of completion/correction by the various design consultants shall occur. Final payment to the contractor shall not be released until the final completion /punch list is complete 100%.
 - B. Upon completion of reinspection, the Architect will then prepare a certificate of final acceptance or advise the Contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance. If necessary, reinspection will be repeated.
- 1.05 **RECORD DRAWINGS:** Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark-up these drawings to show the actual installation where installation varies from that shown originally. Mark whichever drawing is most capable of showing conditions accurately. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Maintain and review monthly with the Owner and Architect.
- A. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover.
 - B. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and lost. Provide access to Project Record Documents for Architect's reference during normal working hours.
 - C. Upon completion of the Work, submit Record Drawings (red-line field as-builts) to the Architect for Owner's records.
 - D. As built documents are a requirement of final close out for the project. As built documents shall include all design revisions issued during the course of the project. Those revisions shall be marked on the documents in a way that provides clarity for the noted changes. It is at the sole discretion of the architect to determine what is and what is not adequate for as built documentation.
 - E. The contractor is expected to maintain as built documents throughout the course of the project work. Monthly review of the as built documents wherein the contractor shall show the architect what changes were accepted and have been noted as revisions to the project ON the as built documents each month.
 - F. Failure to maintain as built documentation during the course of the project may be grounds to hold progress payment.
 - G. Failure to provide adequate as built documentation shall be grounds to hold final payment pending receipt of acceptable as built documentation.
- 1.06 **PROJECT RECORD SPECIFICATIONS:** Maintain one copy of the Project Manual, including addenda. Mark-up to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot be readily discerned later by direct observation. Note related record drawing information and Product Data.
- A. Maintain on site, in a 3-ring binder or other organized method, executed RFI's, ASI's, RFP's, CO's and other project record items.
 - B. All record of revisions is to be incorporated into the Project As-Built drawings
 - C. Upon completion of the Work, submit record Drawings and Specifications to the Architect for the Owner's records.
- 1.07 **PROJECT AS-BUILT DRAWINGS:** The Contractor shall, at his own expense, hire the Architect of Record to prepare as-built drawings. The Contractor shall provide to the Architect record drawings and record specifications. The Contractor is solely responsible for the content of the record drawings and the as-built documents.

SECTION 017700 – CLOSEOUT PROCEDURES (continued):

- A. Site As-built drawings shall comply with the following:
1. Show the actual locations of all components, including depth below grade, along with any changes and/or modifications to the Contract Drawings. Provide GPS coordinates for all below grade installations.
 - a. During the course of the project, various utilities are buried on site. The project as-built documentation for utilities shall include a layout for as-built conditions of all buried underground utility runs to within 3 feet of actual.
 - b. All above ground access points shall be detailed on site as built to within 1 foot of actual with GPS coordinates provided for each item.
 - c. Items to be recorded include but are not limited to water Valves, sewer manholes, storm water manholes, and sewer and storm water cleanouts, electronic junction boxes buried on site, electrical junction boxes buried on site, site transformers, and any other items as indicated on the project design documents.
 - d. All stub outs for utility tie ins shall be indicated on the as built plan.
 - e. All utilities shall be labeled every 50 feet on the as built so as to allow easy identification in the field while using electronic as built plans. All utility items listed in item 3 above shall also be labeled on the as built plans.
 - f. All dimensions and elevations, including invert elevations, shall be verified by field measurements.
 2. The Contractor is cautioned to make all necessary measurements and elevations during installation to accurately locate all concealed items.
- B. As-Built Survey: Contractor shall provide signed and sealed As-Built Survey of existing grades and structures as required by authorities having jurisdictions.

- 1.08 MAINTENANCE MANUALS: Organize maintenance data into sets of manageable size. Bind in individual heavy-duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark identification on front and spine of each binder. Include the following information:

Emergency instructions.	Spare parts list.
Copies of warranties.	Wiring diagrams.
Recommended "turn around" cycles.	Inspection procedures.
Shop Drawings and Product Data.	Fixture lamping schedule.

- 1.09 OPERATING AND MAINTENANCE INSTRUCTIONS: Arrange for the installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Acceptance of the owner training provided is at the sole discretion of the owner. Training provided must be comprehensive in nature and include all pertinent aspects of use and maintenance for the item(s) requiring training. Include a detailed review of the following:

Maintenance manuals.	Spare parts and materials.
Tools.	Lubricants.
Control sequences.	Hazards.
Warranties and bonds.	Maintenance agreements and similar continuing commitments.

As part of instruction for operating equipment, demonstrate the following procedures:

Start-up and shutdown.	Emergency operations.
Noise and vibration adjustments.	Safety procedures.

All operation and training sessions shall be recorded and provided to the Owner. The contractor may use their own personnel to film the training provided. Verify with Owner the appropriate format of recording that should be used.

SECTION 017700 – CLOSEOUT PROCEDURES (continued):

1.10 **FINAL CLEANING:** Employ experienced workers for final cleaning. Clean each surface to the condition expected in a commercial building cleaning and maintenance program. Complete the following, as a minimum before requesting inspection for certification of Substantial Completion:

- A. Remove labels that are not permanent labels.
- B. Clean transparent materials. Remove glazing compound. Replace chipped or broken glass.
- C. Clean exposed hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean.
- D. Vacuum carpeted surfaces.
- E. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
- F. Clean the site of rubbish, litter and other foreign substances. Sweep paved areas; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth even-textured surface.

1.11 **REMOVAL OF PROTECTION:** Remove temporary protection and facilities.

1.12 **CLOSE OUT DOCUMENTATION:**

- A. All close out documents shall be provided in hard copy and identical electronic copy.
- B. Contractor shall provide (2) hard copies for all documents and as built plans.
- C. Contractor shall provide (4) electronic copies identical to hard copies as listed above.
 - a. Contractor shall utilize “thumb drive” media of sufficient size to accommodate entire close out package including all as built documents being saved onto (1) thumb drive encompassing (1) full copy of all documentation on that (1) drive.
 - b. Each successive copy of electronic documents shall be identical and complete.
 - c. Folder structure on the Thumb drive shall be as follows:
 - i. 0 NAME OF PROJECT
 - ii. 1 SCOPE OF WORK
 - iii. 2 AS BUILT DRAWINGS
 - iv. 3 O&M MANUALS
 - v. 4 SUB WARRANTIES
 - vi. 5 CERTIFICATES & PERMITS
 - vii. 6 TEST REPORTS
 - viii. 7 SHOP DRAWINGS
 - ix. 8 DPO VENDOR LETTERS
 - x. 9 AIA WAIVERS G706 & G707
 - xi. 10 ATTIC STOCK
 - d. Subfolder structure on the Thumb drive under items 2, 3, 4 & 7 above shall be as follows:
 - i. ARCHITECTURAL
 - ii. AUDIO VISUAL
 - iii. CIVIL
 - iv. ELECTRICAL
 - v. FIRE ALARM
 - vi. FIRE PROTECTION
 - vii. FURNISHINGS & EQUIPMENT
 - viii. MECHANICAL
 - ix. PLUMBING
 - x. SECURITY

SECTION 017700 – CLOSEOUT PROCEDURES (continued):

- xi. STRUCTURAL
 - xii. TELECOMM
 - e. Under the 'Scope of Work' folder, provide the Title sheet showing Project Information and all Architect & Engineer names and contact information. Provide a separate brief Narrative of the Project Scope, type of Structure, HVAC and other broad project information utilized. In this narrative, if this is a Renovation, provide a list of rooms that were altered during the construction process.
- D. In addition to close out documentation, all spare parts or extra parts required by specification shall be provided at final close out. The method for this to occur is negotiable but final verification including transmittal and owner/architect verification of receipt is a close out requirement.
- E. Contractor MAY NOT deliver close out documents in multiple phases or at multiple times or to multiple parties.
- a. Initial submittal of Close out documents shall be to the Architect for review and comment.
 - b. Upon Architect acceptance, the Contractor shall gather all hard copies and electronic copies for a full and complete documentation deliverable for the project close out documentation.
 - c. In addition to items listed in various parts of the specifications, THE CONTRACTOR SHALL ALSO PROVIDE A COMPREHENSIVE SPREADSHEET THAT LISTS THE NAME AND CONTACT PERSON WITH PHONE NUMBER AND EMAIL FOR EACH SUBCONTRACTOR THAT PERFORMED WORK ON THE PROJECT.
 - d. A Warranty spreadsheet shall also be included showing the term of any warranty provided by the subcontractor, the date the warranty started, and the end date the warranty will be completed on. (see 'Warranty Contact List' attachment).
 - e. The Warranty spreadsheet shall also list any manufacturers extended warranties that may exist for any item under a particular subcontractor's scope. Include the same information listed in item d. above for manufacturer's warranties.
- F. Once the previous item 'E' is finalized and all Work is completed, including ALL punch out, all paperwork, all pay applications submitted with final and retainage applied for and any unspent funds returned, such that the job is closed out and 100% completed with no lingering issues yet to be resolved, then the Contractor shall gather a complete project close out deliverable including both hard copies and electronic copies, warranties, extra parts and any other close out required items, they are to notify the architect that they are ready to schedule the PROJECT CLOSE OUT MEETING.
- a. The closeout meeting will be held at City Hall, 17007 Panama City Beach Pkwy, Panama City Beach, FL 32413. The Contractor is required to schedule the meeting in advance and a formal meeting request sent via email and accepted by all required attendees before the meeting is held.
 - b. A list of the attendees with signatures and contact numbers shall be created and all attendees shall be noted and shall sign in.
 - c. The project close out meeting shall consist of a meeting with all stakeholders including but not limited to the following:
 - i. Facilities PM
 - ii. Maintenance Supervisor
 - iii. Administration for the Project facility
 - iv. Architect, other design consultants as directed by the architect
 - v. Contractor project management team and project executive
 - d. The project close out meeting agenda shall include a recap of the project scope, presentation of a completed and architect approved final punch list.
 - e. Contractor shall deliver close out documents with Transmittals to Facilities & Maintenance for their signature confirming review and acceptance.
 - f. Question and answers will be called for all participants. Any necessary follow up meetings for any lingering items associated with the project will be scheduled and coordination responsibility for each item will be assigned.

SECTION 017700 – CLOSEOUT PROCEDURES (continued):

- g. Contractor will provide meeting minutes for the meeting including action items list and schedule for completion of any action items noted during the project close out meeting
- h. Please note in some instances final financial paperwork may be incomplete or the contract may remain open, but only with the approval of the City of Panama City Beach's PM.

- 1.13 COMPLIANCE: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Remove waste materials from the site and dispose of in a lawful manner.

END OF SECTION 017700

SECTION 017800 - WARRANTIES AND BONDS

PART 1 - GENERAL

- 1.01 **STANDARD PRODUCT WARRANTIES** are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner. Note: All Standard Product Warranties are to be provided.
- 1.02 **SPECIAL WARRANTIES** are written warranties required by or incorporated in Contract Documents, to extend time limits provided by standard warranties or to provide greater rights for the Owner. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.
- A. Requirements for warranties for products and installations that are specified to be warranted, are included in the individual Sections of Divisions-2 through -33.
- 1.03 **DISCLAIMERS AND LIMITATIONS**: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and Subcontractors required to countersign special warranties with the Contractor.
- 1.04 **RELATED DAMAGES AND LOSSES**: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- 1.05 **REINSTATEMENT OF WARRANTY**: When Work covered by a warranty has failed and been corrected, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- 1.06 **REPLACEMENT COST**: On determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through part of its useful service life.
- 1.07 **OWNER'S RECOURSE**: Written warranties made to the Owner are in addition to implied warranties, and shall not limit duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
- A. **Rejection of Warranties**: The Owner reserves the right to reject warranties and limit selections to products with warranties not in conflict with requirements of the Contract Documents. The Owner reserves the right to refuse to accept Work where a special warranty, or similar commitment is required, until evidence is presented that entities required to countersign commitments are willing to do so.
- 1.08 **SUBMIT WRITTEN WARRANTIES** to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion, submit written warranties on the Architect's request.
- A. When a designated portion of the Work is completed and occupied or used, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within fifteen days of completion of that designated portion of the Work.
- B. When a special warranty is to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Architect for approval prior to final execution.

SECTION 017800 - WARRANTIES AND BONDS (continued):

- C. Refer to individual Sections of Divisions-2 through -33 for specific content, and particular requirements for submittal of special warranties.
- D. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
- E. Provide heavy paper dividers with celluloid covered tabs for each warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
- F. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS", the Project title or name, and the name of the Contractor.
- G. When operating and maintenance manuals are required for warranted construction, provide additional copies of each warranty, as necessary, for inclusion in each required manual.

END OF SECTION 017800

SECTION 018113 – SUSTAINABLE DESIGN REQUIREMENTS

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Environmental Goals utilizing the Green Globes rating system.

1.2 DEFINITIONS

- A. Definitions pertaining to sustainable development: As defined in ASTM E2114.

1.3 ENVIRONMENTAL GOALS

- A. Sustainable building rating system:
 - 1. Green Globes – US: Provide work consistent with Green Globes –US level One Globe requirements.
- B. General list of criteria:
 - 1. Energy consumption was reduced at least 15% by ASHRAE 90.1 standards.
 - 2. See Glass & Glazing Specification section for pertinent Visible Transmittance (VT) and U Values.
 - 3. Major energy uses will be sub-metered: hot water system, building system.
 - 4. Major energy efficient systems within the building: Energy-efficient lighting fixtures, lamps and ballasts, Lighting controls, Energy-efficient HVAC equipment, Building automation system, Variable speed drives, Energy-efficient motors
 - 5. Major water-efficient equipment utilized on this project: Low-flush toilets (1.28 gallons/flush), water-saving fixtures on lavatory faucets (.5 gpm) and low-flow kitchen faucets (1 gpm).
 - 6. Utilize durable and low maintenance building materials such as concrete, brick, metal roof, porcelain and vinyl tile.
 - 7. Refrigerants are hydrofluorocarbons with an ozone depleting potential=0.
 - 8. Air intake and exhaust louver openings are suitably protected and appropriately spaced between each other and potential pollution sources. Ventilation lining will avoid the release of pollution and fibers into the ventilation air path.
 - 9. This project has used the Indoor Air Quality procedure and CO2 monitoring.
 - 10. To prevent the growth of fungus, mold, and bacteria on building surfaces and in concealed spaces, the following measure are in place: Anti-microbial Paint, VT, Rubber Tile, Carpet, PT, Controls (BAS), humidity monitor controls the HVAC units.
 - 11. Paint, Vinyl Tile, Carpet, Porcelain Tile and mechanical and electrical mastics, sealants, caulks and adhesives are low-VOC emitting, non-toxic chemically inert.
 - 12. Acoustic control is provided in the classroom with an NRC = .7 for the ACT and STC = 55 at the wall partitions. Duct silencer meet room criteria 25.
 - 13. This is a Tobacco Free Campus.
 - 14. A Solar Reflectance Index (SRI) of 78 or higher must be attained on the roof.

1.4 COORDINATION MEETINGS:

- A. Meetings to inform, confirm and access the progress of the implementation of these green building practices will be held at the following times:
 - 1. Preconstruction meeting
 - 2. 50% Completion
 - 3. Substantial completion

END OF SECTION 018113

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section requires the selective removal and subsequent offsite disposal of, but not necessarily limited to the following:

Concrete floors and walls
Partitions,
Doors, Windows
Roofing
Electrical & plumbing systems.

NOTE: The Reports and specifications indicate general locations where demolition is required, but is not intended to show all possible items or areas of demolition. All demolition required to complete work is in contract.

1.02 SUBMITTALS

- A. Schedule indicating proposed sequence of operations for selective demolition work to Owner's Representative for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.
- B. Photographs of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations. File with Owner prior to start of work.

1.03 JOB CONDITIONS

- A. Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished. Conditions existing at time of inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur by Owner's removal and salvage operations prior to start of selective demolition work.
- B. Damages: Promptly repair damages caused to adjacent facilities by demolition work.
- C. Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
1. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- D. Flame Cutting: Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations.
- E. Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.
1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.
- F. Environmental Controls: Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental

SECTION 024119 - SELECTIVE DEMOLITION (continued):

protection.

1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 PREPARATION

- A. Locate, identify, stub off, and disconnect utility services that are not indicated to remain.
 1. Provide bypass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of 72 hours advance notice to Owner if shutdown of service is necessary during changeover.

3.02 DEMOLITION

- A. Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.
 1. Cut concrete and asphalt at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.
 2. Completely fill below-grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over 6 inches in diameter, roots, or other organic matter.
- B. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner's Representative in written, accurate detail. Pending receipt of directive from Owner, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

3.03 SALVAGED MATERIALS

- A. Salvaged Items: Where indicated on Drawings as "Salvage - Deliver to Owner," carefully remove indicated items, clean, store, and turn over to Owner and obtain receipt.
- B. Historic artifacts, including cornerstones and their contents, commemorative plaques and tablets, antiques, and other articles of historic significance, remain property of Owner. Notify Owner if such items are encountered and obtain acceptance regarding method of removal and salvage for Owner.

3.04 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove from building site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose off site.
 1. If hazardous materials are encountered during demolition operations **notify the Architect and Owner**. Comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

Note: Contractor shall comply with the notice requirements of Chapter 62-257.301, F.A.C., Asbestos Program when renovation or demolition of site or facility involving the removal of a threshold amount of regulated ACM (asbestos containing material) regardless of whether or not asbestos is present. 'Notice of Asbestos Renovation or Demolition', DEP Form Number 62-257.900(1), effective 2-9-99 shall be filed with FDEP (Florida Department of Environmental Protection) ten (10) working days prior to commencement of work.

2. Burning of removed materials is not permitted on project site.

SECTION 024119 - SELECTIVE DEMOLITION (continued):

3.05 **CLEANUP AND REPAIR**

- A. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean.
- B. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 024119

SECTION 033000 - BUILDING CONCRETE WORK

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.
 - d. Columns and beams.
 - e. Slabs on metal deck
 - f. Topping slabs
6. Concrete curing.

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 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:

ACI 301 "Specifications for Structural Concrete for Buildings."

ACI 318 "Building Code Requirements for Reinforced Concrete."

ACI 347 "Recommended Practice for Concrete Formwork."

Concrete Reinforcing Steel Institute, "Manual of Standard Practice."

- 1.04 SUBMITTALS: Submit manufacturer's product data with installation instructions for proprietary materials including reinforcement and forming accessories, admixtures, joint materials, hardeners, curing materials and others as requested by Architect.

- A. Submit design mixes of each individual type of concrete to be used on the project prior to the start of concrete work. Tests shall be made for compressive strength, slump and air entrainment. Proportion mixes in compliance with mix design procedures specified in ACI 301 and requirements stated on the plans.
- B. Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
- C. Concrete Testing Service: The Contractor shall employ, at his sole expense, an independent

SECTION 033000 - BUILDING CONCRETE WORK (continued):

testing agency acceptable to the Architect/Engineer to perform sampling and testing during concrete placement as follows. Refer to Section 01400 for additional requirements for Testing Agency.

1. Sampling: ASTM C 172.
2. Slump: ASTM C 143, one of test for each load at **point of discharge**.
3. Air Content: ASTM C 173, one for each set of compressive strength specimens.
4. Compressive Strength: ASTM C 39, three sets for each 25 cu. yds. or fraction thereof of each class of concrete; one specimen tested at 7 days, two specimens tested at 28 days, and one retained for later testing if required. When the total quantity of a given class of concrete is less than 25 cu. yds., strength tests may be waived by Architect if field experience indicates evidence of satisfactory strength.
5. Test Results will be reported in writing to Architect, Contractor, and concrete producer within 24 hours after tests are made.

1.05 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 MATERIALS

- A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.
 1. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- C. Cylindrical Columns and Supports: Form round-section members with metal, fiberglass reinforced plastic, or paper or fiber tubes. Construct paper or fiber tubes of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.
- D. Form Work Accessories:
 1. Form coating: Form release agent that will not adversely affect concrete surfaces or prevent subsequent application of concrete coatings.

SECTION 033000 - BUILDING CONCRETE WORK (continued):

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: ASTM A 615, Grade 60, deformed.
- 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

- A. Portland Cement: ASTM C 150, Type I, unless otherwise acceptable to Architect.

Use one brand of cement throughout project, unless otherwise acceptable to Architect.
- B. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.
 1. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Architect.
 2. The aggregate shall not exceed 1" in its maximum dimensions for foundation and slab work nor 3/8" (pea gravel) for concrete block lintels and filled cells.
 3. Lightweight Aggregates: ASTM C 330.
 4. Water: Drinkable.
 5. Admixtures
 - a. Air-Entraining Admixture: ASTM C 260.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to the following:
"Sika Aer"; Sika Corp
"MB-VR or MB-AE"; Master Builders
"Dorex AEA"; W.R. Grace
"Edoco 2001 or 2002"; Edoco Technical Product
 - b. Admixtures – general: Admixtures which result in more than 0.1 percent of soluble chloride ions by weight of cement are prohibited.
 - c. Water-reducing Admixture: ASTM C 494, Type A

- 2.04 RELATED MATERIALS: Submit any product not specifically listed in this specification to Architect for approval.

SECTION 033000 - BUILDING CONCRETE WORK (continued):

- A. Vapor Barrier: Provide vapor barrier cover over prepared base material where indicated. Use only materials which meet ASTM 1745-09, not less than 15 mils thick, and are resistant to decay when tested in accordance with ASTM E154. Product must maintain a permeance of less than 0.01 perms after mandatory conditioning tests include in ASTM E 1745-09, Section 7.12, 7.1.3, 7.1.4 and 7.1.5. Install material according to ASTM E 1643-09. Lap vapor barrier a minimum of 6" at all locations.
- B. Non-Shrink Grout: CRD-C 621, factory pre-mixed grout.
 - 1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - a. Non-metallic

"Masterflow 713"; Master Builders
"Euco-NS"; Euclid Chemical Co.
- C. Liquid Membrane Forming Curing Compound: Liquid type membrane-forming curing compound complying with ASTM C 309, Type I, Class A unless other type acceptable to Architect. Moisture loss not more than 0.055 gr./sq. ft. when applied at 200 sq. ft./gal.
 - 1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Masterseal"; Master Builders
"Ecocure"; Euclid Chemical Co.
"Clear Seal"; A. C. Horn
"Kure-N-Seal"; Sonneborn-Contech
- D. Cure, Sealer and Dustproofer: ASTM C-309, containing 250% solids. ADay-Chem Cure & Seal@ (J-22) by Dayton Superior OR approved equal. Surface shall have a high gloss finish.

2.05 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mix for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method is used, use an independent testing facility acceptable to Architect for preparing an reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.
- B. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect.
- C. Design mixes to yield normal weight concrete with the following properties, as indicated on drawings and schedules:

Concrete in slabs and footings shall have a minimum compressive strength of 3000 strength psi and in beams and columns a minimum compressive strength of 4000 psi at 28-days; the maximum W/C ratio shall be 0.46 maximum (air-entrained).

RETEMPERING OR ADDING WATER AT THE JOBSITE IS PROHIBITED.
- D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

SECTION 033000 - BUILDING CONCRETE WORK (continued):

- E. Admixtures: Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus-or-minus 1-1/2% within following limits:

Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or subjected to hydraulic pressure:

4.5% (moderate exposure); 5.5% (severe exposure) 1-1/2" max. aggregate.
5.0% (moderate exposure); 6.0% (severe exposure) 3/4" max. aggregate.

Other Concrete: 2% to 4% air.

- F. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

Ramps, slabs, and sloping surfaces: 4" (+/-1").

Reinforced foundation systems: 4" (+/-1").

Pea gravel pump mix for filled masonry cells (3000 psi) C 8" to 11".

Other concrete: Not more than 4", except when slump is increased by use of super plasticizers.

2.06 CONCRETE MIXES

- A. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.

During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.

When air temperature is between 85°F (30°C) and 90°F (32°C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90°F (32°C), reduce mixing and delivery time to 60 minutes.

Exposed concrete slab concrete shall not be pumped unless it contains super plasticizer or other hydration stabilizer admixture.

- B. The following are strictly prohibited:

- a. Partially hardened concrete.
- b. Contaminated concrete.
- c. Re-tempered concrete.
- d. Concrete that has been re-mixed after it has taken its initial set.

2.07 CONCRETE TOPPING

- A. Provide Level-Right Self-Leveling Floor Underlayment by Maxxon Corporation in locations indicated on drawings. Comply with manufacturer's requirements and the following:

1. Compressive Strengths: Modified ASTM C 109; up to 3000 psi (3 day).
2. Tensile Strength: ASTM C 190; 720 psi (28 day).
3. Surface Burning Characteristic: Flame Spread - 0.
Fuel Contribution - 0.
Smoke Development - 0. (ASTM E 84).
4. Fire Ratings: U.L. Design #J919, L514, L528, L530

SECTION 033000 - BUILDING CONCRETE WORK (continued):

2.08 CONCRETE TOPPING OVER PRECAST HOLLOW CORE CONCRETE PLANKS

- A. Provide structural normal weight concrete topping in locations indicated on drawings. Comply with manufacturer=s requirements and the following:
 - 1. Compressive Strengths: Modified ASTM C 109; 3500 psi, 28 days.
 - 2. Tensile Strength: ASTM C 190; 720 psi, 28 days.
 - 3. Comply with water/cement ratios, blended aggregate mixes and curing requirements specified elsewhere in this section.

PART 3 - EXECUTION

3.01 FORMS

- A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.
 - B. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.
 - C. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, keyways, recesses, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.
 - D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.
 - E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set time to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.
 - F. Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to product uniform smooth lines and tight edge joints.
 - G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.
 - H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.
- 3.02 **PLACING REINFORCEMENT:** Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports, and as herein specified.

SECTION 033000 - BUILDING CONCRETE WORK (continued):

- A. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete. Reinforcing must also be free of non-shop bends or kinks.
- B. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- C. Place reinforcement to obtain at least minimum coverage's for concrete protection and lap as specified by ACI. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- D. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.
- E. Reinforcing bars shall be free of kinks and non-shop bends. Field bends shall only be installed as directed by the Architect.

3.03 JOINTS

- A. Construction Joints: Locate and install keyed construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Architect.
- B. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.
- C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints.
- 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, such as column pedestals, foundation walls, grade beams and elsewhere as indicated.

Joint filler and sealant materials are specified in Division-7 sections of these specifications.

- E. Contraction (Control) Joints in Slabs-on-Ground: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. If not shown, provide joints recommended by ACI Standards, but no more than 16' o.c. Use inserts 1/8" to 1/4" wide x 1/4 of slab depth, unless otherwise indicated.
- F. Form contraction joints by inserting premolded plastic, hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

Contraction joints may be formed by saw cuts as soon as possible after slab finishing and without dislodging aggregate. Depth of saw cut to be 1/4 of slab thickness.

- G. Joint sealant material is specified in Division-7 sections of these specifications.
- H. Clean construction joints prior to placement of concrete including removal of all laitance. Immediately before concrete is placed, wet all construction joints and remove all standing water.
- I. Waterstops: Provide waterstops as indicated, installing to form continuous, watertight dam, with

SECTION 033000 - BUILDING CONCRETE WORK (continued):

field joints fabricated in strict accordance with the manufacturer's instructions.

- 3.04 **INSTALLATION OF EMBEDDED ITEMS:** Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in- place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.

- A. **Edge Forms and Screed Strips for Slabs:** Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.05 **PREPARATION OF FORM SURFACES**

- A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.
- B. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.
- C. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

3.06 **CONCRETE PLACEMENT**

- A. **Preplacement Inspection:** Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast- in. Notify other crafts to permit installation of their work, cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.
- B. **Coordinate** the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.
- C. **General:** Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," and as herein specified.
- D. **Deposit concrete** continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- E. **Placing Concrete in Forms:** Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic, to avoid cold joints. Concreting operations shall be carried on at such a rate that the concrete is at all times plastic.
- F. **Consolidate placed concrete** by mechanical vibrating equipment supplemented by hand- spading, Roding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

SECTION 033000 - BUILDING CONCRETE WORK (continued):

- G. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- H. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
- I. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
- J. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
- K. Maintain reinforcing in proper position during concrete placement operations.
- L. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306.
- M. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
- N. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.
- O. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305.
- P. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
- Q. Concrete is prohibited from being placed if the concrete is partially hardened, contaminated, re-tempered, or if it has been re-mixed after its initial set.

3.07 FINISH OF FORMED SURFACES

- A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed concrete surfaces exposed to view, or that are to be covered with a coating material applied directly, to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.

SECTION 033000 - BUILDING CONCRETE WORK (continued):

- C. Grout Cleaned Finish: Provide grout cleaned finish to cylindrical column surfaces which have received smooth form finish treatment.

Combine one part portland cement to 1-1/2 parts fine sand by volume, and mix with water to consistency of thick paint. Proprietary additives may be used at Contractor's option. Blend standard portland cement and white portland cement, amounts determined by trial patches, so that final color of dry grout will match adjacent surfaces.

Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

3.08 MONOLITHIC SLAB FINISHES

- A. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint or other thin film finish coating system.

After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand- troweling operation, free of trowel marks, uniform in texture and appearance, and with a level surface plane so that depressions between high spots do not exceed 1/8" under a 10' straightedge. Grind smooth surface defects which would telegraph through applied floor covering system.

- B. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete sidewalks, steps and ramps, and elsewhere as indicated.

Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.09 CONCRETE CURING AND PROTECTION: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Keep continuously moist for not less than 7 days at 50°F. minimum temperature. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

- A. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.

Where sealed concrete is the Afinish floor@, moist curing is required. Where interior slabs are to be covered with VCT, resilient flooring, or carpet, etc., curing method is Contractor=s Option.

- B. Provide moisture curing by following methods.

Keep concrete surface continuously wet by covering with water.

Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

- C. Provide moisture-cover curing as follows:

SECTION 033000 - BUILDING CONCRETE WORK (continued):

Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

- D. Provide curing and sealing compound to interior slabs with resilient flooring, carpet over cushion; and to exterior slabs, walks, and curbs, as follows:

Applied specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

- E. After moist curing of exposed concrete floor areas, provide two (2) coats of sealing compound.

Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, damp-proofing, membrane roofing, flooring (such as ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to Architect.

- F. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

- G. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing method.

Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

- H. Sealer and Dustproofer: Apply a second coat of specified curing and sealing compound only to surfaces given a first coat.

3.10 REMOVAL OF FORMS AND SHORING

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50° F (10° C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.
- B. Formwork or shoring supporting weight of concrete, such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28-days. Determine potential compressive strength of in place concrete by testing field-cured specimens representative of concrete location or members.
- C. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.
- D. Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until concrete has attained 100 percent of specified compressive strength. In addition, the contractor shall have determined that the actual compressive strength attained is adequate to support the weight of the concrete and superimposed loads.

SECTION 033000 - BUILDING CONCRETE WORK (continued):

- E. Keep supports in place until heavy loads due to construction operations have been removed.
 - F. Test field-cured specimens to determine potential compressive strength of concrete for specific locations.
- 3.11 **RE-USE OF FORMS:** Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged from facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.
- 3.12 **MISCELLANEOUS CONCRETE ITEMS**
- A. **Filling-In:** Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.
 - B. **Curbs:** Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.
 - C. **Equipment Bases and Foundations:** Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.
 - D. **Grout** base plates and foundations as indicated, using specified non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.
 - E. **Reinforced Masonry:** Provide concrete for reinforced masonry lintels and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.
- 3.13 **CONCRETE SURFACE REPAIRS**
- A. **Patching Defective Areas:** Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.

Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush- coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.
 - B. **For exposed-to-view surfaces,** blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
 - C. **Repair of Formed Surfaces:** Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning; flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

SECTION 033000 - BUILDING CONCRETE WORK (continued):

- D. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
- E. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.
- F. Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement of completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets and other objectionable conditions.
- G. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.
- H. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect.
- I. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finish concrete. Cure in same manner as adjacent concrete.
- J. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry-pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.
- K. Perform structural repairs with prior approval of Architect or method and procedure, using specified epoxy adhesive and mortar.
- L. Repair methods not specified above may be used, subject to acceptance of Architect.

3.14 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. The Contractor will employ a testing laboratory to perform tests and to submit test reports.
- B. Sampling and testing for quality control during placement of concrete includes the following, as directed by Architect.
- C. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.
 - 1. Slump: ASTM C143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
 - 2. Air Content: ASTM C 173; volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each day's

SECTION 033000 - BUILDING CONCRETE WORK (continued):

pour of each type of air- entrained concrete.

3. Concrete Temperature: Test hourly when air temperature is 40°F (4°C) and below, and when 80°F (27°C) and above; and each time a set of compression test specimens made.
4. Compression Test Specimen: ASTM C31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens.
5. Compressive Strength Tests: ASTM C39; one set for each day's pour exceeding 5 cu. yds. plus additional sets for each 25 cu. yds. over and above the first 25 cu. yds. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

When frequency of testing will provide less than 2 strength tests for a given class of concrete, conduct testing from each batch.

6. Acceptance of Concrete Strength:
The concrete strength will be considered satisfactory if both the following requirements are met:
 - A. Every arithmetic average of any three consecutive strength tests equals or exceeds f'_c .
 - B. No individual strength test (average of two cylinders) falls below the f'_c by more than 500 psi.
- D. Test results will be reported in writing to Architect. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, compressive breaking strength and type of break for both 7-day tests and 28-day tests.
- E. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required when unacceptable concrete is verified.

END OF SECTION 033000

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.01 QUALITY ASSURANCE

- A. Single Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.
- B. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.
- C. Preconstruction Tests by Unit Test Methods: Test the following materials by methods indicated:
 - 1. Concrete Masonry Units: Test each type, class and grade of concrete masonry unit per ASTM C 140.
 - 2. Mortar Tests: Test each mortar type per ASTM C780.
- D. Preconstruction Tests by Prism Methods: For each type of wall construction indicated for testing, test masonry prisms per ASTM E 447, Method B and as follows:
 - 1. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.
 - 2. Fabricate concrete masonry prisms with height-to-thickness ratio of not less than 1.33 nor more than 3.0.
 - 3. Flexural Bond Strength Tests: Where indicated, also test prisms per ASTM C 518; place prisms with tooled joints facing downward.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for each type of masonry unit, accessory, and other manufactured products, including certifications that each type complies with specified requirements.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry materials to project in undamaged condition.
- B. Store and handle masonry units to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion or other causes.
 - 1. Limit moisture absorption of concrete masonry units during delivery and until time of installation to the maximum percentage specified for Type I units for the average annual relative humidity as reported by the U.S. Weather Bureau Station nearest project site.
 - 2. Store cementitious materials off the ground, under cover and in dry location.
 - 3. Store aggregates where grading and other required characteristics can be maintained.
 - 4. Store masonry accessories including metal items to prevent deterioration by corrosion and accumulation of dirt.

1.04 PROJECT CONDITIONS

- A. Protection of Work: During erection, cover top of walls with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.
- B. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
- C. Do not apply uniform floor or roof loading for at least 12 hours after building masonry walls or columns.

SECTION 04200 - UNIT MASONRY (continued):

- D. Do not apply concentrated loads for at least 3 days after building masonry walls or columns.
- E. Staining: Prevent grout or mortar or soil from staining the face of masonry to be left exposed or painted. Remove immediately grout or mortar in contact with such masonry.
- F. Protect base of walls from rain-splashed mud and mortar splatter by means of covering spread on ground and over wall surface.
- G. Protect sills, ledges and projections from droppings of mortar.
- H. Cold Weather Protection:
 - 1. Do not lay masonry units which are wet or frozen.
 - 2. Remove any ice or snow formed on masonry bed by carefully applying heat until top surface is dry to the touch.
 - 3. Remove masonry damaged by freezing conditions.

PART 2 - PRODUCTS

- 2.01 CONCRETE MASONRY UNITS: Comply with referenced standards and other requirements indicated below applicable to each form of concrete masonry unit required.
 - A. Provide special shapes where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions. Use 45E block at all locations where walls intersect at a 45E angle.
 - B. Provide square-edged units for outside corners, except where indicated as bullnose.
 - C. Grade N except Grade S may be used above grade in exterior walls with weather protective coatings and in walls not exposed to weather.
 - D. Typical Size: Manufacturer's standard units with nominal face dimensions of 16" long x 8" high (15-5/8" x 7-5/8" actual) x thicknesses indicated.
 - E. Block Shapes:
 - 1. Standard Block: 8" x 8" x 16" standard gray.
 - 2. 45E Block: 8" x 8" x 8" - 16".
 - 3. Bull Nose Block: 8" x 8" x 16".
 - 4. Pre-Cast Water Table: 4" x 8" x 16". With outside corner and top horizontal edge chamfered.
 - F. Type II, non-moisture controlled units.
 - G. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

Note: All CMU, visible to view and not designated to receive a finish on Finish Schedule or elsewhere in the documents, shall receive block filler and paint as specified in Section 09900, except mechanical chases. Mechanical chases are not to be painted.
 - H. Hollow Loadbearing Block: Requirements for block when delivered to job site. ASTM C 90 and as follows:
 - 1. Weight Classification: Light weight.
 - 2. Minimum Compressive Strength: 1900 psi (average of 3 units).
 - 3. Maximum Percent with Slight Cracks and Chips: 5%.

SECTION 04200 - UNIT MASONRY (continued):

2.02 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold weather construction. Provide natural color or white cement as required to produce required mortar color.
- B. Water: Clean and potable.

2.03 JOINT REINFORCEMENT, TIES, AND ANCHORING DEVICES:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

Dur-O-Wall, Inc.
Masonry Reinforcing Corp. of America
National Wire Products Corp.
- B. Materials: Comply with requirements indicated below for basic materials and with requirements indicated under each form of joint reinforcement, tie and anchor for size and other characteristics:
 - 1. Hot-Dip Galvanized Steel Wire: ASTM A 82 for uncoated wire and ASTM A 153 for zinc coated wire.
 - 2. Application: Use for masonry exposed to exterior and in contact with earth.
- C. Joint Reinforcement: Provide welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10', with prefabricated corner and tee units, and complying with requirements indicated below:
 - 1. Width: Fabricate joint reinforcements in units with widths of approximately 2" less than nominal width of walls and partitions as required to provide mortar coverage of not less than 5/8" on joint faces exposed to exterior and 1/2" elsewhere.
 - 2. Wire Size for Side Rods: 9 gauge.
 - 3. Wire Size for Cross rods: 9 gauge.
 - 4. For single-wythe masonry provide type as follows with single pair of side rods:
Ladder design spaced not more than 16" o.c.
- D. Anchor Bolts: Provide steel bolts with hex nuts and flat washers complying with ASTM A 307, Grade A, hot-dip galvanized to comply with ASTM C 153, Class C, in sizes and configuration indicated.

2.04 MASONRY CLEANERS

- A. Job-Mixed Detergent Solution: Solution of trisodium phosphate (1/2 cup dry measure) and laundry detergent (1/2 cup dry measure) dissolved in one gallon of water. **Verify with block manufacturer.**

2.05 MORTAR AND GROUT MIXES: Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, anti-freeze compounds or other admixtures, unless otherwise indicated.

Do not use calcium chloride in mortar or grout.

- A. Mixing: Combine and thoroughly mix cementitious, water and aggregates in a mechanical batch mixer; comply with referenced ASTM standards for mixing time and water content.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for types of mortar required, unless otherwise indicated.
 - 1. Use Type S mortar for reinforced masonry and where indicated.

SECTION 04200 - UNIT MASONRY (continued):

2. Use Type N mortar for exterior, above-grade non-loadbearing walls; for interior non-loadbearing walls; and for other non-loadbearing applications where another type is not indicated.
 - C. Grout (Pea Gravel Conc.) for Unit Masonry: Comply with ASTM C 476 for grout for use in construction of reinforced and nonreinforced unit masonry. Use grout of consistency indicated or if not otherwise indicated, of consistency (fine or coarse) at time of placement which will completely fill all spaces intended to receive grout. Concrete used as block fill for reinforced masonry cells shall have a minimum 28 day compressive strength of 3000 psi.
 1. Use coarse grout in grout spaces 4" or more in least horizontal dimension, unless otherwise indicated.
- 2.06 VERTICAL EXPANSION JOINTS: Provide ASlot Seal Wide Flange 2016-3" expansion joints by Williams Products, Inc. OR approved equal, unless detailed on drawings otherwise.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Do not wet concrete masonry units.
- B. Cleaning Reinforcing: Before placing, remove loose rust, ice and other coatings from reinforcing.
- C. Thickness: Build cavity and composite walls, floors and other masonry construction to the full thickness shown. Build single-wythe walls (if any) to the actual thickness of the masonry units, using units of nominal thickness indicated.
- D. Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match work immediately adjacent to the opening.
- E. Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining work. Use full-size units without cutting where possible.

Use dry cutting saws to cut concrete masonry units.
- F. Minimum length of masonry lintels is 16" longer than the required opening (8" minimum bearing each end).
- G. Vertical wall reinforcing steel terminating in tie beams should extend to within 2" of top surface of tie beam and terminate using a standard 90-degree ACI hook.

3.02 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces of columns, and walls, do not exceed 1/4" in 10', or 3/8" in a story height not to exceed 20', nor 1/2" in 40' or more. For external corners, expansion joints, control joints and other conspicuous lines, do not exceed 1/4" in any story or 20' maximum, nor 1/2" in 40' or more. For vertical alignment of head joints do not exceed plus or minus 1/4" in 10', 1/2" maximum.
- B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4" in any bay or 20' maximum, nor 1/2" in 40' or more. For top surface of bearing walls do not exceed 1/8" between adjacent floor elements in 10' or 1/16" within width of a single unit.

SECTION 04200 - UNIT MASONRY (continued):

- C. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls and partitions, do not exceed 1/2" in any bay or 20' maximum, nor 3/4" in 40' or more.
- D. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4" nor plus 1/2".
- E. Variation in Mortar Joint Thickness: Do not exceed bed joint thickness indicated by more than plus or minus 1/8", with a maximum thickness limited to 1/2". Do not exceed head joint thickness indicated by more than plus or minus 1/8".

3.03 LAYING MASONRY WALLS

- A. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to accurately locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units at corners, jambs and wherever possible at other locations.
- B. Lay-up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other work.
- C. Pattern Bond: Lay exposed masonry in running bond with vertical joint in each course centered on units in courses above and below. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2". Bond and interlock each course of each wythe at corners. do not use units with less than nominal 4" horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Rack back 1/2-unit length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if required) and remove loose masonry units and mortar prior to laying fresh masonry.
- E. Built-in Work: As the work progresses, build-in items specified under this and other sections of these specifications. Fill in solidly with masonry around built-in items.
 - 1. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
 - 2. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
 - 3. Fill cores in hollow concrete masonry units with grout under bearing plates, beams, lintels, posts and similar items, unless otherwise indicated.
- F. Inspection and clean out holes shall be utilized when grouting height exceeds five (5) feet. Clean out holes shall be the width of the masonry cell and a minimum of 3" high. Grout space requirements for various pour heights shall conform to Table 7, ACI 530-08.

3.04 MORTAR BEDDING AND JOINTING

- A. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.
- B. Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not shown, lay walls with 3/8" joints.
- C. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials, unless otherwise indicated.

SECTION 04200 - UNIT MASONRY (continued):

- D. Tool exposed joints slightly concave using a jointer larger than joint thickness, unless otherwise indicated.
- E. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners or jambs to shift adjacent stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

3.05 **HORIZONTAL JOINT REINFORCEMENT:** Provide continuous horizontal joint reinforcement at 16" C-C. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls 1/2" elsewhere. Lap reinforcing a minimum of 6".

- A. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- B. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bed reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

Space continuous horizontal reinforcement as follows:

For single-wythe walls, space reinforcement at 16" o.c. vertically, unless otherwise indicated.

- C. Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcement placed in 2 horizontal joints approximately 8" apart, immediately above the lintel and immediately below the sill. Extend reinforcement a minimum of 2'-0" behind jambs of the opening except at control joints.

3.06 **CONTROL AND EXPANSION JOINTS**

- A. Vertical Control Joints: Provide control joints in CMU walls to allow for movement resulting from shrinkage and creep. Provide control joints as detailed and at locations shown on drawings, or if not shown, as indicated below. Provide control joints in both exterior and interior walls, and in both loadbearing and non-loadbearing conditions.
 - 1. At maximum spacing of 50 feet on center.
 - 2. At all abrupt changes in wall height.
 - 3. At all changes in wall thickness, such as those at pipe or duct chases and those adjacent to columns or pilasters.
 - 4. Above joints in foundations and floors.
 - 5. Below joints in roofs and floors that bear on the wall.
 - 6. At a distance of not over one-half the allowable joint spacing from bonded intersections or corners.
 - 7. At one or both sides of all door and window openings unless other crack control measures are used such as joint reinforcement or bond beams.

SECTION 04200 - UNIT MASONRY (continued):

- B. Vertical Expansion Joints: Provide sheer lugs at expansion joints in exterior masonry veneer to allow for movement resulting from changes in temperature, moisture expansion, etc. Provide expansion joints as detailed and at locations shown on drawings, or as indicated below.

Wall/building expansion joints shall be aligned thru entire wall construction.

Control joints in veneer masonry need not be aligned with back-up masonry in cavity wall construction.

**CONTROL JOINT SPACING FOR MOISTURE CONTROLLED
TYPE I
CONCRETE MASONRY UNITS**

Recommended Spacing of Control Joints	Vertical Spacing of Joint Reinforcement			
	None	24"	16"	8"
Expressed as ratio of Panel length to height L/H	2	2-1/2	3	4
With Panel Length (l) Not to Exceed:	40'	45'	50'	60'

3.07 **FIELD QUALITY CONTROL**

- A. Contractor shall employ, at his own expense, a testing laboratory experienced in performing types of masonry field quality control tests for masonry indicated. Comply with requirements for qualification and acceptance of testing laboratory specified in Part 1 for preconstruction testing service.
- B. Remove and replace masonry units which have cracked do to shrinkage or settlement problems. Provide new units to match adjoining units and install in fresh mortar, pointed to eliminate evidence of replacement.
- C. Unit Test Method:
1. Concrete Masonry Unit Tests: For each type, class and grade of concrete masonry unit indicated, test units by method of sampling and testing of ASTM C 140.
 2. Mortar Tests: For each type indicated, test mortar by methods of sampling and testing of ASTM C 780. Conduct tests no less frequently than that required to evaluate mortar used to install each increment of masonry units indicated above from which samples are taken for testing.
- D. Prism Test Method:
1. Compression Test: For each type of wall construction indicated for testing, test masonry prisms by methods of sampling and testing of ASTM E 447, Method B, and as follows:

Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.
- E. Report test results in writing and in form specified under each test method, to Architect and Contractor, on same day tests are made.
- F. Evaluation of Quality Control Tests: Masonry work, in absence of other indications of noncompliance with requirements, will be considered satisfactory if results from construction quality control tests comply with minimum requirements indicated.

SECTION 04200 - UNIT MASONRY (continued):

3.08 REPAIR, POINTING AND CLEANING

- A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Remove and replace masonry units which have cracked do to shrinkage or settlement problems. Provide new units to match adjoining units and install in fresh mortar, pointed to eliminate evidence of replacement.
- C. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints, including corners, openings, and adjacent work, to provide a neat, uniform appearance, prepared for application of sealants.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Clean concrete unit masonry to comply with masonry manufacturer's directions and applicable NCMA "Tek" bulletins.
 - 4. Do not use acid or abrasives on finish surfaces of ground faced accent block.
- E. Protection: Provide final protection and maintain conditions in a manner acceptable to Installer, which ensures unit masonry work being without damage and deterioration at time of substantial completion.

END OF SECTION 04200

SECTION 051200 - STRUCTURAL STEEL

PART 1 - GENERAL

1.01 **RELATED DOCUMENTS:** Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 **DESCRIPTION OF WORK:**

- A. Extent of structural steel work is shown on drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.
- B. Structural steel is that work defined in AISC "Code of Standard Practice" and as otherwise shown on drawings.
- C. Miscellaneous Metal Fabrications are specified elsewhere in Division 5.

1.03 **QUALITY ASSURANCE**

- A. Codes and Standards: Comply with provisions of following, except as otherwise indicated:
 - 1. AISC "Code of Standard Practice for Steel Buildings and Bridges"
 - 2. Paragraph 4.2.1 of the above code is hereby modified by deletion of the following sentence: "This approval constitutes the Design Builder's acceptance of all responsibility for the decision adequacy of any connections designed by the fabricator as a part of his preparation of these shop drawings."
 - 3. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings," including "Commentary" and Supplements thereto as issued.
 - 4. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
 - 5. AWS D1.1 "Structural Welding Code"
 - 6. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use"
- B. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure." Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests. Certification must be current (less than 1 year old). If recertification of welders is required, retesting will be Contractor's responsibility. Contractor must furnish a copy of each welders current certification prior to welder performing work on the project.
- C. Installer Qualifications: Engage an experienced installer who has completed structural steel work similar in material, design, and extent to that indicated for this project and with a record of successful in-service performance.
- D. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the work.
 - 1. Fabricator must participate in the AISC Quality Certification Program and be designated an AISC-Certified Plant as follows:

SECTION 051200 - STRUCTURAL STEEL (continued):

- a. Category: Category I, conventional steel structures.
- b. Fabricator shall be registered with and approved by authorities having jurisdiction.
- E. Firms wishing to bid the work, but not participating in the AISC Certification, may seek pre-qualification by making submittals as listed in paragraph 1.04 Submittals, Para. D. of this section.
- F. Whether by Certification or by Pre-Qualification, the steel fabricator shall have in their employ a specialty Engineer responsible for designing and detailing all structural connections and have responsible charge of shop drawing preparation. Fabricator shall anticipate and include in his bid all miscellaneous plates, angles, welds, or bolts necessary to accomplish the connection. Specialty Engineer shall sign and seal shop drawings indicating responsibility for connections only, and certifying that main members are as indicated on the contract documents. Connections shall be capable of resisting forces equal to the strength of the member being connected, when such forces are not shown on the plans.

1.04 SUBMITTALS

- A. **Product Data:** Submit producer's or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
 - 1. Structural steel (each type).
 - 2. High-strength bolts (each type), including nuts and washers.
 - 3. Structural steel primer paint.
 - 4. Shrinkage-resistant grout.
- B. **Shop Drawings:** Submit shop drawings, including complete details and schedules for fabrication and assembly of structural steel members procedures and diagrams. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.

Shop drawings relating to the connections shall be signed and sealed by the fabricators engineer, who is registered in the project state.

Any submittal or RFI shall be incorporated as part of the shop drawings. The first and all shop drawing submittals shall include the signature and seal of the Specialty Engineer, noting the purpose of the submittal.
- C. **Test Reports:** Submit copies of reports of tests conducted on shop and field bolted and welded connections. Include data on type(s) of tests conducted and test results.
- D. Qualification data for firms and persons specified in the AQuality Assurance@ Article to demonstrate their capabilities and experience. Include lists of completed projects with project name and address, name and address of Architect and Design Builder, and the name and address of the Specialty Engineer proposed for the work.

1.05 DELIVERY, STORAGE AND HANDLING

- A. **Deliver materials** to site at such intervals to insure uninterrupted progress of work.
- B. **Deliver anchor bolts** and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.

SECTION 051200 - STRUCTURAL STEEL (continued):

- C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
- D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Metal Surfaces, General: For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.
- B. Structural Steel Shapes, Plates and Bars: ASTM A 572, except channels, angles, bars, plates and other miscellaneous items shall be ASTM A36.
- C. Cold-Formed Steel Tubing: ASTM A 500, Grade B.
- D. Steel Pipe: ASTM A 53, Type E or S, Grade B.
- E. Anchor Bolts: ASTM A 307, nonheaded type unless otherwise indicated.
- F. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:
 - 1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A 325.
 - 2. Direct tension indicator washers may be used at Contractor's option.
- G. Electrodes for Welding: Comply with AWS Code.
- H. Structural Steel Primer Paint: Fabricator's standard rust-inhibiting primer.
- I. Non-metallic Shrinkage-Resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica, sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C621.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

Euco N.S.; Euclid Chemical Co.
Masterflow 713; Master Builders
Five Star Grout; U.S. Grout Corp.

2.02 FABRICATION

- A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

SECTION 051200 - STRUCTURAL STEEL (continued):

- B. Connections: Weld or bolt shop connections, as indicated. Weld field connections, except where bolted connections or other connections are indicated.
 - 1. Provide high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.
 - 2. Provide unfinished threaded fasteners for only bolted connections of secondary framing members to primary members (including purlins, girts, and other framing members taking only nominal stresses) and for temporary bracing to facilitate erection.
- C. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" (RCRBSJ).
- D. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work. Build up welded door frames attached to structural steel framing. Weld exposed joints continuously and grind smooth. Plug weld steel bar stops to frames, except where shown removable. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10" o.c., unless otherwise indicated.
- E. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.03 SHOP PAINTING

- A. General: Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar or that is scheduled to receive sprayed on fireproofing. Paint embedded steel which is partially exposed on exposed portions and initial 2" of embedded areas only.
 - 1. Do not paint surfaces which are to be welded or high-strength bolted with friction-type connections.
 - 2. Apply 2 coats of paint to surfaces which are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- B. Surface Preparation: After inspection and before shipping, clean steel work to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:
 - 1. SP-2 "Hand Tool Cleaning"
 - 2. SP-3 "Power Tool Cleaning"
- C. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 1.5 mils. Use painting methods which result in full coverage of joints, corners, edges and exposed surfaces.

SECTION 051200 - STRUCTURAL STEEL (continued):

PART 3 - EXECUTION

3.01 ERECTION

- A. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignments of structures as erection proceeds.
- B. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.
- C. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations. Refer to Division 3 of these Specifications for anchor bolt installation requirements in concrete, and Division 4 for masonry installation.
- D. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
- E. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to backing with grout.
- F. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure. For proprietary grout materials, comply with manufacturer's instructions.
- G. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure within specified AISC tolerances. Employ surveyor to plumb columns with transit.
 - 2. Splice members only where indicated and accepted on shop drawings.
- H. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.
- I. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
- J. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.

SECTION 051200 - STRUCTURAL STEEL (continued):

- K. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

3.02 QUALITY CONTROL

- A. Engage an independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports. Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.
- B. Shop Bolted Connections: Inspect in accordance with AISC specifications.
- C. Shop Welding: Inspect and test during fabrication of structural steel assemblies, as follows:
 - 1. Use Current Certified welders (certifications not over 1 year old) and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
 - 2. Perform visual inspection of all welds.
- D. Field Bolted Connections: Inspect in accordance with AISC specifications.
- E. Field Welding: Inspect and test during erection of structural steel as follows:
 - 1. Use Current Certified welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
- F. Completion Certification: Upon completion of erection, fabricator engineer shall certify that all connections have been completed in accordance with the shop drawings and contract documents.

END OF SECTION 051200

SECTION 053000 - METAL DECKING

PART 1 - GENERAL

RELATED DOCUMENTS:

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

DESCRIPTION OF WORK:

Extent of metal decking is indicated on drawings, including basic layout and type of deck units required.

QUALITY ASSURANCE:

Codes and Standards: Comply with provisions of the following codes and standards, except as otherwise indicated or specified:

AISI "Specification for the Design of Cold-Formed Steel Structural Members".

AWS "Structural Welding Code".

SDI "Design Manual for Floor Decks and Roof Decks".

Qualification of Field Welding: Qualify field welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

Welded decking in place is subject to inspection and testing. Expense of removing and replacing portions of decking for testing purposes will be borne by Owner if welds are found to be satisfactory. Remove work found to be defective and replace with new acceptable work.

SUBMITTALS:

Product Data: Submit manufacturer's specifications and installation instructions for each type of decking and accessories. Include manufacturer's certification as may be required to show compliance with these specifications.

Shop Drawings: Submit detailed drawings showing layout and types of deck panels, anchorage details, including fastener type, size and pattern and conditions requiring closure panels, supplementary framing, sump pans, cant strips, cut openings, special jointing or other accessories. Shop drawings shall be signed and sealed by the engineer, registered in the project state, who supervised their preparation. Drawings shall certify that proposed roof fasteners will safely resist wind uplift.

See plans for additional requirements for roof decks.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS:

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

Metal Roof Deck Units:

Bowman/E.G. Smith, Div. Cyclops Corp.
Roll Form Products, Inc.
United Steel Deck, Inc.

Vulcraft/Div. Nucor Corp.
Wheeling Corrugating Co.

SECTION 05300 - METAL DECKING (continued):

Permanent Form Floor Deck Units:

Bowman/E.G. Smith, Div. Cyclops Corp.
Roll Form Products, Inc.
United Steel Deck, Inc.

Vulcraft/Div. Nucor Corp.
Wheeling Corrugating Co.

MATERIALS:

Steel for Painted Metal Deck Units: ASTM A 611, Grade C.

Steel for Galvanized Metal Deck Units: ASTM A 653.

Miscellaneous Steel Shapes: ASTM A 36.

Sheet Metal Accessories: ASTM A 526, commercial quality, galvanized.

Galvanizing: ASTM A 525, G60.

Galvanizing Repair Paint: High zinc-dust content paint for repair of damaged galvanized surfaces complying with Military Specifications MIL-P-21035 (Ships).

Flexible Closure Strips: Manufacturer's standard vulcanized, closed-cell, synthetic rubber.

FABRICATION:

General: Form deck units in lengths to span 3 or more supports, with flush, telescoped or nested 2" laps at ends and interlocking or nested side laps, unless otherwise indicated.

Roof Deck Units: Provide deck configurations complying with SDI "Roof Deck Specifications", of metal thickness, depth and width as shown.

Metal Cover Plates: Fabricated metal cover plates for end-abutting floor deck units of not less than same thickness as decking. Form to match contour of deck units and approximately 6" wide.

Metal Closure Strips: Fabricate metal closure strips, for openings between decking and other constructions, of not less than 0.045" min. (18 gage) sheet steel. Form to provide tight-fitting closures at open ends of cells or flutes and sides of decking.

PART 3 - EXECUTION

INSTALLATION:

General: Install deck units and accessories in accordance with manufacturer's recommendations and final shop drawings, and as specified herein.

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.

Place deck units flat and square, secured to adjacent framing without warp or excessive deflections.

Do not place deck units on concrete supporting structure until concrete has cured and is dry.

Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.

Do not use floor deck units for storage or working platforms until permanently secured.

SECTION 053000 - METAL DECKING (continued):

Fastening Deck Units:

Fasten floor deck units to steel supporting members by not less than 3/4" diameter fusion welds or elongated welds of equal strength, using weld washers spaced not more than 12" o.c. with a minimum of 2 welds per unit at each support.

Tack weld at 4'-0" o.c. for fastening end closures.

Fasten roof deck units to steel supporting members as shown on the contract documents. Install sidelap fasteners at spacing as shown on the contract drawings. In addition, connect deck to perimeter supporting structure at 6" o.c. at all panel edges.

Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.

Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking, as shown.

Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown.

Hanger Slots or Clips: Provide UL approved punched hanger slots between flutes of lower element where floor deck units are to receive hangers or support of ceiling construction, air ducts, diffusers, or lighting fixtures.

Locate slots or clips at not more than 14" o.c. in both directions, not over 9" from walls at ends, and not more than 12" from walls at sides, unless otherwise shown.

Joint Covers: Provide metal joint covers at abutting ends and changes in direction of floor deck units, except where taped joints are required.

Closure Strips: Provide metal closure strips at open uncovered ends and edges of decking, and in voids between decking and other construction. Weld into position to provide a complete decking installation.

Provide flexible closure strips instead of metal closures, at Contractor's option, wherever their use will ensure complete closure. Install with adhesive in accordance with manufacturer's instructions.

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.

Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.

In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.

END OF SECTION 053000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous steel framing and supports.
2. Shelf angles.
3. Metal ladders.
4. Metal floor plate and supports.
5. Structural-steel door frames.
6. Miscellaneous steel trim.
7. Metal bollards.
8. Wire rope.
9. Pipe and Downspout guards.
10. 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.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Metal nosings and treads.
2. Paint products.
3. Grout.
4. Railings

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Samples for Verification: For each type and finish of extruded nosing and tread.

D. 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. Structural Performance of Aluminum Ladders: Aluminum ladders, including landings, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

C. Structural Performance of Handrails and Toprails shall withstand concentrated loads of 200 lbf applied at any point in any direction and a uniform load of 50 lbf per lin. ft. applied simultaneously in both vertical and horizontal directions. All railings fabricated and installed shall comply with ADA requirements.

SECTION 054000 – METAL FABRICATIONS (continued):

- D. 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.
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

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. Stainless-Steel Bars and Shapes: ASTM A 276, Type 316L.
- D. 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.
- E. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- F. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface or with abrasive material metallurgically bonded to steel].
 - 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. IKG Industries, a division of Harsco Corporation; Mebac.
 - b. SlipNOT Metal Safety Flooring; SlipNOT.
- G. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- H. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- I. 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.
- J. 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.
- K. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- L. Aluminum Extrusions: ASTM B 221 , Alloy 6063-T6.
- M. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- N. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- O. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).

SECTION 054000 – METAL FABRICATIONS (continued):

- P. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).
- Q. 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 exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior 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.

SECTION 054000 – METAL FABRICATIONS (continued):

- 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.

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.
- D. Prime shelf angles located in exterior walls with primer specified in Section 099600 "High-Performance Coatings."
- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

SECTION 054000 – METAL FABRICATIONS (continued):

2.8 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, except for elevator pit ladders.
2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Steel Ladders:

1. Space siderails 16 inches apart unless otherwise indicated.
2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
3. Rungs: 3/4-inch square square steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung.
6. Galvanize exterior ladders, including brackets.
7. Prime exterior ladders, including brackets and fasteners, with primer specified in Section 099600 "High-Performance Coatings."

C. Aluminum Ladders:

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. ACL Industries, Inc.
 - b. Alco-Lite Industrial Products.
 - c. Halliday Products.
 - d. O'Keeffe's Inc.
 - e. Precision Ladders, LLC.
 - f. Royalite Manufacturing, Inc.
 - g. Thompson Fabricating, LLC.
2. Space siderails 16 inches apart unless otherwise indicated.
3. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.
4. Rungs: Extruded-aluminum tubes, not less than 3/4 inch deep and not less than 1/8 inch thick, with ribbed tread surfaces.

2.9 LADDER SAFETY CAGES

- A. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless-steel fasteners.
- B. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet o.c. Provide secondary intermediate hoops spaced not more than 48 inches o.c. between primary hoops.
- C. Galvanize steel ladder safety cages, including brackets and fasteners.
- D. Prime steel ladder safety cages, including brackets and fasteners, with primer specified in Section 099600 "High-Performance Coatings."

2.10 METAL FLOOR PLATE

- A. Fabricate from rolled-steel floor or rolled-stainless-steel floor as indicated on drawings.
- B. Provide steel or stainless-steel angle supports as indicated.
- C. Provide flush stainless-steel bar drop handles for lifting removable sections, one at each end of each section.

SECTION 054000 – METAL FABRICATIONS (continued):

2.11 ELEVATOR PIT SUMP COVERS

- A. Fabricate from 1/8-inch rolled-steel floor plate with four 1-inch diameter holes for water drainage and for lifting.

2.12 STRUCTURAL-STEEL DOOR FRAMES

- A. Fabricate structural-steel door frames from steel shapes, plates, and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch steel channel stops. Plug-weld built-up members and continuously weld exposed joints. Reinforce frames and drill and tap as necessary to accept finish hardware.
 - 1. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.
- B. Prime exterior steel frames with primer specified in Section 099600 "High-Performance Coatings."

2.13 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."

2.14 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
 - 1. Cap bollards with 1/4-inch thick steel plate.
- 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."

2.15 PIPE AND DOWNSPOUT GUARDS

- A. Fabricate pipe and downspout guards from 3/8-inch thick by 12-inch wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch clearance between pipe and pipe guard. Drill each end for two 3/4-inch anchor bolts.
- B. Galvanize pipe and downspout guards.

2.16 ABRASIVE METAL NOSINGS, TREADS, AND THRESHOLDS

- A. Cast-Metal Units: Cast iron with an integral-abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both.
 - 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. American Safety Tread Co., Inc.
 - b. Balco, Inc.
 - c. Barry Pattern & Foundry Co., Inc.

SECTION 054000 – METAL FABRICATIONS (continued):

- d. Granite State Casting Co.
 - e. Safe-T-Metal Company, Inc.
 - f. Wooster Products Inc.
 - B. Extruded Units: Aluminum, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder.
 - 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. ACL Industries, Inc.
 - b. American Safety Tread Co., Inc.
 - c. Amstep Products.
 - d. Armstrong Products, Inc.
 - e. Balco, Inc.
 - f. Granite State Casting Co.
 - g. Wooster Products Inc.
 - 2. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
 - 3. Provide solid-abrasive-type units without ribs.
 - C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
 - D. Drill for mechanical anchors and countersink. Locate holes not more than 4 inches from ends and not more than 12 inches o.c.
 - E. Apply bituminous paint to concealed surfaces of cast-metal units.
 - F. Apply clear lacquer to concealed surfaces of extruded units.
- 2.17 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.
- 2.18 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.
 - C. Prime loose steel lintels located in exterior walls with primer specified in Section 099600 "High-Performance Coatings."
 - D. Paint and caulk when installed in exterior wall veneer.
- 2.19 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.
- 2.20 FINISHES, GENERAL
- A. Finish metal fabrications after assembly.

SECTION 054000 – METAL FABRICATIONS (continued):

- 2.21 Exterior Railings: Fabricate using Schedule 80 aluminum.
- 2.22 Interior Railings: Fabricate using steel pipe. ASTM A 53, type and grade as required for design loading (if applicable), black finish unless galvanizing indicated; standard weight (Schedule 40) unless otherwise indicated. All handrails shall be 1 ½" o.d.
- 2.23 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.

SECTION 054000 – METAL FABRICATIONS (continued):

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.

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 055000

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

- 1.01 **Lumber, General:** Manufacture lumber, S4S and grade stamped, to comply with PS 20 and applicable grading rules of inspection agencies certified by ALSC's Board of Review. Provide seasoned lumber with 19 percent moisture content at time of dressing and shipment, for sizes 2" or less in thickness.
- 1.02 **Blocking:** All wood blocking shall be a minimum 3/4" plywood. This applies to backing supporting for millwork, headwalls, oak crash rails, toilet accessories, metal lockers, t.v. brackets, etc. or unless otherwise indicated in drawings or by manufacturer of the product being hung.
- A. Wood blocking methods shall be approved by manufacturers of all wall supported systems.
- 1.03 **Related Sections:**
- A. Section 102800 - Toilet and Bath Accessories for blocking requirements.
- B. Section 111132 - Projection Screens and T.V. Brackets.

PART 2 - PRODUCTS

- 2.01 **Dimension Lumber:**
- A. **Construction grade light-framing lumber (2"-4" thick, 2"-4" wide):** Any species graded under WWPA or WCLIB rules or Southern Pine graded under SPIB rules or Western Spruce-Pine-Fir graded under NLGA rules.
- B. **Studs (2"-4" thick, 2"-6" wide, 10' and shorter):** "Stud" or No. 3 Structural Light Framing grade, any species graded under WWPA, WCLIB, SPIB OR NLGA rules.
- 2.02 **Lumber for Miscellaneous Uses:** Unless otherwise indicated, provide Standard grade lumber for support of other work, including bucks, nailers, blocking, furring, grounds, stripping and similar members.
- 2.03 **Fasteners and Anchorages:** Of size, type, material and finish suited to application shown and of quality equal to products by Simpson Strong Tie Co., Inc. Provide metal hangers and framing anchors of size and type recommended for intended use by manufacturer. Hot-dip galvanize fasteners and anchorages for work exposed to weather, in ground contact and high relative humidity to comply with ASTM A 153.
- 2.04 **Preservative pressure treat** lumber with water-borne preservatives to comply with AWPA C2 and C9, respectively, and with AWPB LP-22 (Wood for Ground Contact Use) and AWPB LP-2 (Wood for Above-Ground Use).
- A. **Treat nailers,** blocking, and similar items in conjunction with flashing and treat sills, blocking, furring, and similar items in direct contact with masonry or concrete.
- 2.05 **WALL SUPPORT SYSTEM AND ROUGH-IN REQUIREMENTS:** Provide blocking as recommended by the manufacturer for all wall hung items.

PART 3 - EXECUTION

- 3.01 **Install rough carpentry work** to comply with "Manual of House Framing" by National Forest Products Assoc. (N.F.P.A.) and with recommendations of American Plywood Association (APA), unless otherwise indicated. For sheathing and other products not covered in above standards, comply with recommendations of manufacturer of product involved for use intended. Set carpentry work to required levels and lines, with members plumb and true and cut to fit.

SECTION 061000 – ROUGH CARPENTRY (continued):

- 3.02 Securely attach carpentry work to substrates and supporting members using fasteners of size that will not penetrate members where opposite side will be exposed to view or receive finish materials. Install fasteners without splitting wood; fasten panel products to allow for expansion at joints unless otherwise indicated.
- 3.03 Provide wood framing members of size and spacing indicated; do not splice structural members between supports.

END OF SECTION 061000

SECTION 064000 - PLASTIC LAMINATE CLAD FIXED CABINETS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and Division 1, apply to work of this section.

1.02 DESCRIPTION OF WORK: Extent of each type of architectural millwork is indicated on drawings. Types of architectural millwork include laminate clad cabinets including tops and opaque shelving.

1.02 QUALITY ASSURANCE

- A. AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI) and American Laminators Association (ALA), except as otherwise indicated.
- B. Installer Qualifications: Arrange for installation of architectural millwork items by same firm which fabricated them.

1.03 SUBMITTALS

- A. Shop Drawings: Submit shop drawings showing the location of each item, dimensioned plans and elevations, large scale details, joinery, attachment devices and other components. All shop drawings shall indicate use of particle board with minimum density of 45# throughout panels and plywood.
- B. Samples: Submit samples of plastic laminate and all cabinet hardware, one unit of each type and finish.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect millwork during transit, delivery, storage and handling to prevent damage, soiling and deterioration.
- B. Do not deliver millwork until painting, wet work, grinding and similar operations which could damage, soil, or deteriorate millwork have been completed in installation areas. If, due to unforeseen circumstances, millwork must be stored in areas other than installation areas, store only in areas meeting requirements specified for installation areas.

1.05 PROJECT CONDITIONS

- A. Conditioning: Millwork Manufacturer and Installer shall advise Contractor of temperature and humidity requirements for millwork installation and storage areas. Do not install millwork until the required temperature and relative humidity have been stabilized and will be maintained in installation areas.
- B. Maintain temperature and humidity in installation area as required to maintain moisture content of installed millwork within a 1.0 percent tolerance of optimum moisture content, from date of installation through remainder of construction period. Require Millwork Manufacturer to establish optimum moisture content and required temperature and humidity conditions.

PART 2 – PRODUCTS

2.01 ACCEPTABLE LAMINATE MANUFACTURER

- A. Manufacturer: Wilsonart, Formica, Pionite, Nevamar or approval equal.

SECTION 064000 - PLASTIC LAMINATE CLAD FIXED CABINETS (continued):

2.02 MATERIALS

- A. ARCHITECTURAL CABINETS AND SHELVING UNITS, LAMINATE CLAD: Comply with the following requirements:

Grade: Custom.

Construction: Semi-Reveal Overlay. Panel Type Construction.

- Note:**
1. **All construction shall be 3/4", 45# density particleboard throughout panel; except at cabinets with sinks.**
 2. **All cabinets over 36" wide to have 3/4" continuous top.**
 3. **Shelving units over 33" wide shall have vertical divider support or reinforced.**
 4. **Drawer bottoms over 24" wide shall be reinforced.**
 5. **Cabinets shall have a separate and continuous pressure treated sub-base. Cabinet sides to floor will not be acceptable.**
 6. **Use the largest sheets of laminate available to avoid butt seams. Butt seams will only be accepted when larger sheet size is unavailable.**

Plastic Laminate for Exposed and Semi-exposed Surfaces: Vertical grade (VGP – 0.028") for vertical surfaces.

Edge Treatment: Doors and drawers shall receive 3mm PVC banding, machine applied with waterproof hot melt adhesive with external edges and outside corners machine profiled to 1/8" radius for safety; Cabinet bodies and shelving shall receive 1mm PVC banding, machine applied with waterproof hot melt adhesive. Shelves shall have 1mm PVC banding on the front and back edge.

Concealed Surfaces: 120 gram minimum Thermofused Melamine finish. Color to be selected by Architect.

Colors: See Color Legend in the Finish Plans. PVC color selections shall include wood grains and patterns, and **not** be limited to stock colors.

Comply with AWI Section 400 and its Division 400B.

- B. ARCHITECTURAL CABINET TOPS: High Pressure Decorative Laminate.

Grade: Custom.

Plastic Laminate for Exposed Surfaces: Horizontal grade (HGS – 0.048") for horizontal surfaces.

Edge Treatment: 3mm PVC banding, machine applied with waterproof hot melt adhesive with external edges and outside corners machine profiled.

Colors: See Color Legend in Finish Plans. PVC color selections shall include wood grains and patterns, and **not** be limited to stock colors.

Comply with AWI Section 400 and its Division 400C.

Grommets: Provide one (1) 2½" grommet by Doug Mockett & Co. Inc. (800-523-1269) for each 48" length workstation countertop or as shown on drawings. Locations to be determined in the field by Owner.

- Note:**
1. **Counter tops to be 3/4" plywood with 1-1/4" built-up front edge.**
 2. **All counter tops to receive backer sheet. Countertops with no base shall have a solid underside with backer sheet. No bare substrate in any location is acceptable.**
 3. **Exposed corners shall have 1-1/2" radius.**
 4. **Tops over 36" wide to receive 3/4" continuous top with backer sheet. Counter tops longer than 36" shall have intermediate supports at 36" o.c.**

- C. CABINET HARDWARE AND ACCESSORY MATERIALS

Concealed Hinges: Grass 3000 Series, self-closing, 110E swing, 2 per door and 4 per door on units over 60" high.

Metal Drawer Slides: BHMA A156.9, Zargen Drawer Slide System.

Box Drawer Slides (Grade 1HD-100): For drawers not more than 6 inches high and 24 inches wide.

Metal Drawer Sides: Height shall be within 1" of depth of face of drawer.

Pulls: Hafele, Model 117.31.436, 153mm wide x 30mm deep; steel with a matte chrome finish. 1 per door or drawer.

SECTION 064000 - PLASTIC LAMINATE CLAD FIXED CABINETS (continued):

Shelf Pins 5mm pin holes with dual pin, anti-tip shelf supports suitable for 3/4" or 1" shelving. 32mm line bore holes with double pin reinforced supports tested for over 250 lbs. with anti-lift supports to provide a non-tip feature suitable for 3/4" or 1" thick shelving.

D. FASTENERS AND ANCHORS:

1. Screws: Select material, type, size and finish required for each use. Comply with FS FF-S-111 for applicable requirements.
2. Nails: Select material, type, size and finish required for each use. Comply with FS FF-N-105 for applicable requirements.
3. Anchors: Select material, type, size and finish required by each substrate for secure anchorage. Provide non-ferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion-resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent millwork anchorage.

2.03 FABRICATION, GENERAL

- A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber at time of fabrication and for relative humidity conditions in the installation areas.
- B. Fabricate millwork to dimensions, profiles, and details indicated with openings and mortises precut, where possible, to receive hardware and other items and work.
- C. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- D. Pre-Cut Openings: Fabricate architectural millwork with pre-cut openings, where possible, to receive hardware, appliances, plumbing fixtures, electrical work and similar items. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape. Smooth edges of cutoffs and, where located in countertops and similar exposures seal edges of cutouts with a water-resistant coating. Exposed openings to receive plastic grommets.
- E. Measurements: Before proceeding with fabrication of millwork required to be fitted to other construction, obtain field measurements, and verify dimensions and shop drawing details as required for accurate fit.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Condition millwork to average prevailing humidity conditions in installation areas prior to installing.
- B. Prior to installation of architectural millwork, examine shop fabricated work for completion, and complete work as required, including back priming and removal of packing.

3.02 INSTALLATION

- A. Install millwork plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including tops); and with no variations in flushness of adjoining surfaces.
- B. Scribe and cut millwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

SECTION 064000 - PLASTIC LAMINATE CLAD FIXED CABINETS (continued):

- C. Anchor millwork to anchors or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fasteners heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with millwork, and matching final finish where transparent finish is indicated.
- D. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.
- E. Tops: Anchor securely to base units and other support systems as indicated.

3.03 **ADJUSTMENT, CLEANING, FINISHING, AND PROTECTION**

- A. Repair damaged and defective millwork where possible to eliminate defects functionally and visually, where not possible to repair replace millwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate and adjust hardware.
- C. Clean millwork on exposed and semi-exposed surfaces. Touch-up shop-applied finishes to restore damaged or soiled areas.
- D. Complete the finishing work specified as work of this section, to whatever extent not completed at shop or prior to installation of millwork.
- E. Provide final protection and maintain conditions, in a manner acceptable to Fabricator and Installer, which ensures architectural millwork being without damage or deterioration at time of substantial completion.

END OF SECTION 064000

SECTION 066510 - SOLID SURFACE FABRICATIONS

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 horizontal and trim solid surface product types:
 - 1. Window sills
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for Blocking.

1.3 DEFINITION

- A. Solid surface is defined as nonporous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

1.4 SUBMITTALS

- A. Product data:
 - 1. For each type of product indicated.
- B. Shop drawings:
 - 1. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices and other components.
 - a. Show full-size details, edge details, thermoforming requirements, attachments, etc.
 - b. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement specified in other Sections.
 - c. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, and other items installed in solid surface.
- C. Samples:
 - 1. For each type of product indicated.
 - a. Submit minimum 2-inch by 2-inch sample in specified gloss.
- D. Product data:
 - 1. Indicate product description, fabrication information and compliance with specified performance requirements.
- E. Product certificates:
 - 1. For each type of product, signed by product manufacturer.
- G. Fabricator/installer qualifications:
 - 1. Provide copy of certification number.
- H. Manufacturer certificates:
 - 1. Signed by manufacturers certifying that they comply with requirements.
- I. Maintenance data:
 - 1. Submit manufacturer's care and maintenance data, including repair and cleaning instructions.

SECTION 066510 - SOLID SURFACE FABRICATIONS (continued):

- a. Maintenance kit for finishes shall be submitted.
2. Include in project closeout documents.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 1. Shop that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.
- B. Fabricator/installer qualifications:
 1. Work of this section shall be by a certified fabricator/installer, certified in writing by the manufacturer.
- C. Applicable standards:
 1. Standards of the following, as referenced herein:
 - a. American National Standards Institute (ANSI)
 - b. American Society for Testing and Materials (ASTM)
 - c. National Electrical Manufacturers Association (NEMA)
 - d. NSF International
 2. Fire test response characteristics:
 - a. Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1) Flame Spread Index: 25 or less.
 - 2) Smoke Developed Index: 450 or less.
- D. Coordination drawings:
 1. Shall be prepared indicating:
 - a. Miscellaneous steel for the general work.
 - b. Indicate location of all walls (rated and non-rated), blocking locations and recessed wall items, etc.
 2. Content:
 - a. Project-specific information, drawn accurately to scale.
 - b. Do not base coordination drawings on reproductions of the contract documents or standard printed data.
 - c. Indicate dimensions shown on the contract drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements.
 - d. Provide alternate sketches to designer for resolution of such conflicts.
 - 1) Minor dimension changes and difficult installations will not be considered changes to the contract.
- E. Drawings shall:
 1. Be produced in 1/2-inch scale for all fabricated items.
- F. Drawings must be complete and submitted to the architect within 60 days after award of contract for record only.
 1. No review or approval will be forthcoming.
 2. Coordination drawings are required for the benefit of contractor's fabricators/installers as an aid to coordination of their work so as to eliminate or reduce conflicts that may arise during the installation of their work.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver no components to project site until areas are ready for installation.
- B. Store components indoors prior to installation.
- C. Handle materials to prevent damage to finished surfaces.

SECTION 066510 - SOLID SURFACE FABRICATIONS (continued):

1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.7 WARRANTY

- A. Provide manufacturer's warranty against defects in materials.
 1. Warranty shall provide material and labor to repair or replace defective materials.
 2. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.
 3. Warranty shall be transferable to subsequent owner for remainder of warranty period.
- B. Manufacturer's warranty period:
 1. Fifteen years from date of substantial completion.

1.8 MAINTENANCE

- A. Provide maintenance requirements as specified by the manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
 1. Subject to compliance with requirements, provide products by one of the following:
 - a. Corian, Wilsonart, LG Hausys (HI-MACS®) OR Approved Equal.

2.2 MATERIALS

- A. Solid polymer components
 1. Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.
 2. Superficial damage to a depth of 0.010 inch (.25 mm) shall be repairable by sanding and/or polishing.
- B. Thickness:
 1. 1/2 inch
- C. Edge treatment:
 1. 1-1/4" built up front edge with 1/8" eased edges

- I. Performance characteristics:

<u>Property</u>	<u>Typical Result</u>	<u>Test</u>
Tensile Strength	6,000 psi	ASTM D 638
Tensile Modulus	1.5 x 10 ⁶ psi	ASTM D 638
Tensile Elongation	0.4% min.	ASTM D 638
Flexural Strength	10,000 psi	ASTM D 790
Flexural Modulus	1.2 x 10 ⁶ psi	ASTM D 790
Hardness	>85 Rockwell "M" Scale	ASTM D 785
Thermal Expansion	2.2 x 10 ⁻⁵ in./in./°F	ASTM D 696
Fungus and Bacteria Resistance	Does not support microbial growth	ASTM G21&G22
Microbial Resistance	Highly resistant to mold growth	UL 2824
Ball Impact Resistance (sheets)	0.5 lbs (0.23 kg) ball 1/4" slab—36" drop 1/2" slab—144" drop	NEMA LD 3-2000
Weatherability	ΔE* ₉₄ <5 in 1,000 hrs.	ASTM G155
Flammability		ASTM E 84, NFPA 255 & UL 723

SECTION 066510 - SOLID SURFACE FABRICATIONS (continued):

Class	A	NFPA 101, Life Safety Code
Flame Spread	<25	NFPA 255 & UL 723
Smoke Developed	<25	

2.3 ACCESSORIES

- A. Joint adhesive:
 - 1. Manufacturer's standard one- or two-part adhesive kit to create inconspicuous, nonporous joints.
- B. Sealant:
 - 1. Manufacturer's standard mildew-resistant, FDA-compliant, NSF 51-compliant (food zone — any type), UL-listed silicone sealant in colors matching components.

2.4 FACTORY FABRICATION

- A. Shop assembly
 - 1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.
 - 2. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints.
 - a. Reinforce with strip of solid polymer material, 2" wide.
 - 3. Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings.
 - 4. Rout and finish component edges with clean, sharp returns.
 - a. Rout cutouts, radii and contours to template.
 - b. Smooth edges.
 - c. Repair or reject defective and inaccurate work.

2.5 FINISHES

- A. Color: To be selected from price group C.
- B. Finish:
 - 1. Provide surfaces with a uniform finish.
 - a. Matte; gloss range of 5–20.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
 - 1. Provide product in the largest pieces available.
 - 2. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
 - a. Exposed joints/seams shall not be allowed.
 - 3. Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the seam with the strip being the same thickness as the top.
 - 4. Cut and finish component edges with clean, sharp returns.
 - 5. Rout radii and contours to template.
 - 6. Anchor securely to base cabinets or other supports.

SECTION 066510 - SOLID SURFACE FABRICATIONS (continued):

7. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
8. Carefully dress joints smooth, remove surface scratches and clean entire surface.
9. Install countertops with no more than 1/8-inch (3 mm) sag, bow or other variation from a straight line.

3.3 REPAIR

- A. Repair or replace damaged work which cannot be repaired to architect's satisfaction.

3.4 CLEANING AND PROTECTION

- A. Keep components clean during installation.
- B. Remove adhesives, sealants and other stains.

END OF SECTION 066510

SECTION 071326 - WATERPROOFING

PART 1 - GENERAL

- 1.01 **Product Data:** Submit product data and general recommendations from waterproofing materials manufacturer, including data substantiating that materials comply with requirements.
- 1.02 **Manufacturer:** Obtain primary waterproofing materials of each type required from a single manufacturer, to greatest extent possible. Provide secondary materials only as recommended by manufacturer of primary materials.
- 1.03 **Project Conditions:** Proceed with work after substrate construction, openings, and penetrating work have been completed. Start waterproofing and associated work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturers' recommendations and warranty requirements.

PART 2 - PRODUCTS

- 2.01 **Rubberized Asphalt Sheet Waterproofing:** Self-adhering membrane of rubberized asphalt integrally bonded to polyethylene sheeting, formed into uniform flexible sheets of thickness shown, or not less than 56 mils. Comply with the following:
 - A. **Tensile Strength:** 250 psi min; ASTM D 412.
 - B. **Ultimate Elongation:** 300 percent min; ASTM D 412.
 - C. **Brittleness Temperature:** minus 25 deg F (minus 32 deg C); ASTM D 746.
 - D. **Hydrostatic Head Resistance:** 150 feet min.
 - E. **Water Absorption:** Not more than 0.5 percent weight gain after 48 hours of immersion at 70 deg F (21 deg C); ASTM D 570.
 - F. **Products:** Subject to compliance with requirements, provide one of the following:
 - Bituthene; W. R. Grace & Co.
 - Mel-rol; W.R. Meadows, Inc.
 - Polyguard 650; Polyguard Products, Inc.
 - Miradri; Mirafi, Inc.
 - G. **Locations of use:** Elevator Pit, Stage wall and locations where soil comes in contact with an exterior wall adjacent to an interior space.
 - H. For underslab conditions, use Polyguard Products, Inc.'s 85 mil, pre-concrete pour 'UnderSeal' Underslab waterproofing membrane or equal.
- 2.02 **Roof Underlayment:** 40 mil thick, self-adhering membrane polymer modified bituminous sheet material equal to "Ice and Water Shield" by W. R. Grace.
 - A. **Tensile Strength:** 250 psi; ASTM D 412.
 - B. **Ultimate Elongation:** 250 percent min; ASTM D 412.
 - C. **Adhesion:** 3.0; ASTM D 903.
 - D. **Permeance:** 0.05; ASTM E 96.

SECTION 071326 - SHEET MEMBRANE WATERPROOFING (continued):

2.03 **Auxiliary Materials:** Provide the following materials:

- A. **Adhesives:** Provide types of adhesive compound and tapes recommended by waterproofing sheet manufacturer, for bonding to substrate (if required), for waterproof sealing of seams in membrane, and for waterproof sealing of joints between membrane and flashings, adjoining surfaces and projections through membrane.
- B. **Primers:** Provide type of concrete primer recommended by manufacturer of sheet waterproofing material for applications required.
- C. **Flashing Materials:** Except as otherwise indicated, provide types of flexible sheet material for flashing as recommended by waterproofing sheet manufacturer.

PART 3 – EXECUTION of SHEET MEMBRANES

- 3.01 **Preparation:** Comply with manufacturer's instruction for surface preparation. Apply primer to concrete and masonry surfaces at rate recommended by manufacturer of primary waterproofing materials. Prime only area that will be covered by WP membrane in same working day; reprime areas not covered by WP membrane within 24 hours.
- 3.02 **Installation:** Comply with manufacturer's instructions for handling and installation of sheet waterproofing materials.
 - A. **Coordinate installation** of waterproofing materials and associated work to provide complete system complying with combined recommendations of manufacturers and installers involved in work. Schedule installation to minimize period of exposure of sheet waterproofing materials.
 - B. **Extend waterproofing sheet and flashings** as shown to provide complete membrane over area indicated to be waterproofed. Seal to projections through membrane and seal seams. Bond to vertical surfaces and also, where shown or recommended by manufacturer, bond to horizontal surfaces.
 - C. **Install protection board** over completed membrane, complying with manufacturer's recommendations for both waterproofing sheet and protection course materials.
- 3.03 **Cleaning:** After completion, remove any masking materials and stains from exposed surfaces caused by waterproofing installation. Provide protection of completed membrane during installation of work over membrane and throughout remainder of construction period.

END OF SECTION 071326

SECTION 072100 - BUILDING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes thermal insulation, acoustical insulation, and exterior wall insulation as indicated and/or specified complete.

1.02 Fire Performance Characteristics: Provide insulation materials identical to those whose indicated fire performance characteristics have been determined per ASTM E 119, ASTM E 84, and ASTM E 136, as applicable, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.

1.03 SUBMITTALS: Submit product data for each form and type of insulation indicated.

1.04 Insulation, including facing, exposed to the return air plenum, shall have a Flame Spread Index = 25 or less and a Smoke Developed Index = 450 or less when tested per ASTM E 84 or UL®723.

PART 2 - PRODUCTS

2.01 Roof Deck Insulation: 5.2", R-30 min. per **LTTR (Long Term Thermal Resistance) Values CAN / ULC - S770**, Polyisocyanurate foam insulation board. AC Foam III by Atlas Roofing Corporation OR approved equal. **Note: 3" : R-17.4.**

2.02 Polycynene Spray Insulation: Manufactured by Icynene, Inc. OR approved equal. Spray insulation shall be icynene, hydrophobic, low-density, open-cell modified polycynene; conforming with the following:

A. Thermal Resistance: ASTM C518; 3.6 hr/sq ft/degree F/BTU In.

B. Air Permeance (for 5.25 inches of material): ASTM E283; 0.0049 l/m2/second.

C. Water Vapor Transmission (for 5 inches of material): ASTM E96; 10 perms.

D. Sound Transmission Class (STC): ASTM E90; STC 37 in wood stud wall.

E. Noise Reduction Coefficient (NRC): ASTM E90; NRC-0.7 in wood stud wall.

F. Flame Spread and Smoke Developed rating: ASTM E84; Flame Spread < 25; Smoke Development < 450.

G. Locations: Gables, knee walls, fascias, soffits and other areas within building envelope and where shown on contract documents.

H. Installation shall be in accordance with manufacturer's written application instructions.

2.03 Thermal Barrier for Polycynene Spray Insulation: JM Spider Insulation manufactured by Johns Manville OR approved equal. Spray foam insulation to be sprayed **over** spray polyurethane foam (SPF) insulation providing a thermal barrier and shall conform with the following:

A. Complying with ASTM E-84 and ASTM E-136.

B. Must limit the average temperature rise of the SPF to not more than 250°F (120°C) after 15 minutes of fire exposure, complying with the standard time-temperature curve of ASTM E 119 or UL 263. The thermal barrier shall be installed in such a manner that it will remain in place for 15 minutes based on FM 4880, UL 1040, NFPA 286 or UL 1715.

SECTION 072100 - BUILDING INSULATION (continued):

- 2.04 **Semi-Rigid Spray Applied Polyurethane Foam:** Two-component, open celled, spray-applied, semi-rigid polyurethane foam system. "SEALECTION 500" manufactured by Demilec USA LLC OR approved equal. Product shall comply with the following:
- A. **Thermal Resistance:** ASTM C518; 3.81 hr/sq ft/degree F/BTU In.
 - B. **Air Permeance:** ASTM E283 @ 25 mph; 0.00013 ft³/sq. ft.
 - C. **Water Vapor Transmission:** ASTM E96; 3.6 perms.
 - D. **Sound Transmission Class (STC):** ASTM E90; STC 39.
 - E. **Flame Spread and Smoke Developed rating:** ASTM E84; Class I; Flame Spread 21; Smoke Development 216.
 - F. Installation shall be in accordance with manufacturer's written application instructions.
- 2.05 **Intumescent Coating:** Water base, fire protection intumescent coating, "BlazeLok TB" manufactured by Demilec USA LLC OR approved equal. 14 mil coating applied over semi-rigid spray applied polyurethane foam insulation (SEALECTION). Installation shall be in accordance with manufacturer's written application instructions.
- 2.06 **Acoustical Insulation:**
- A. Mineral fiber sound batts, R-11, unfaced (non-combustible). Flame spread - 25 maximum as tested by ASTM # 84-75.
 - B. Acoustical insulation is required above ceilings at toilets, unless "full height" sound insulated walls are specified. STC rating shall be 45 to 51 in walls and ceilings. Vinyl backed insulation shall be used in open air plenum spaces.
- 2.07 **Extruded Polystyrene Board Insulation:** Rigid, cellular polystyrene thermal insulation with foil skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C 578 for type indicated; with 5-year aged r-values of 5.4 and 5 at 40 and 75 deg. F (4.4 and 23.9 deg. C), respectively; per inch of thickness in manufacturer's standard lengths and widths; thicknesses as indicated.
- 2.08 **Vapor Barrier:** Provide vapor barrier at all exterior wood / metal stud construction and as indicated on drawings. Vapor barrier (6 mil) shall be "DURA-SKRIM 6WW" by Raven Industries, Inc. (800) 635-3456 OR approved equal. Vapor barrier shall meet or exceed ASTM E 84 standard, Class 'A', and shall comply with the following:
- A. **Perm Rating:** 0.07
 - B. **Tensile Strength:** 42 lbf.
 - C. **Elongation at Break:** 450%.
- 2.09 **Perimeter Fire-Containment Systems (Fire Safing):** Where indicated for gaps between the perimeter edge of fire-resistance-rated floor assemblies and non-fire-resistance-rated exterior curtains walls, provide a perimeter fire-containment system with the fire-test-response characteristics indicated, as determined by testing identical systems per UL 2079 by UL and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

PART 3 - EXECUTION

- 3.01 **GENERAL:** Comply with insulation manufacturer's instructions for installation of insulation.
- A. **Support** insulation units by adhesive or mechanical anchorage or both as applicable to location and

SECTION 072100 - BUILDING INSULATION (continued):

conditions indicated.

3.02 INSTALLATION

- A. Batt Insulation: Provide Batt insulation as indicated. Install insulation with edges butted snugly, leaving no open areas. Support securely with staples, clips, tape or fasteners, as required. Install in accordance with the manufacturer's directions and recommendations.
 - 1. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage, to provide permanent placement and support of units.
 - 2. At interior ceilings, where indicated, install on top of drywall or acoustical tile, as shown, fastening securely. Do not install insulation over light fixtures. Maintain 3" clearance from all light fixtures.
 - 3. At ceilings, install on cross runners. Wire tie and fasten to prevent sag.
- B. Wall Insulation:
 - 1. Install as per manufacturer's specifications, using licensed and approved installers.
- C. Vapor Barrier: Overlap vapor barrier 6" and tape with 4" black seaming tape as recommended by manufacturer.

END OF SECTION 072100

SECTION 074113 - PREFORMED WALL AND ROOF PANELS

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. Standing seam metal roof/siding panels for the exterior walls/roofs as shown on the Drawings.
- B. All metal trim, accessories, fasteners, sealants, anchor bolts, and all miscellaneous building components or accessories indicated on the Drawings or needed for a complete and weathertight roof installation.

1.02 SUBMITTALS:

- A. Shop Drawings: Furnish detailed drawings showing profile and gauge of interior and exterior sheets, location and type of fasteners, location, gauges, shape and method of attachment of all trim, location and type of sealants, and any other details as may be required for a weathertight installation.
- B. Samples: Provide two (2) full width by one (1) foot long samples of roof panels in finish specified.

1.03 DEFINITIONS:

- A. Manufacturer: Terms such as manufacturer, panel manufacturer and roofing manufacturer are defined as the material supplier.
- B. Roofing Contractor: Terms such as roofing contractor are defined as the installer.
- C. Roofing Team: Terms such as roofing team are defined as the material supplier and the installer.

1.03 WARRANTY:

Notice of Intent to Issue Roof Warranty: **Manufacturer must complete form and provide to General Contractor for inclusion in Bid Package.** Form is included in section.

Metal Roofing Guarantee: Complete form at the end of this section.

Warranties: Provide 20-year leak free written warranty jointly issued by Panel Manufacturer and Roofing Contractor with full material and labor plus General Contractor's overhead and profit. Provide Panel Manufacturer's 20-year written finish warranty.

This joint warranty, comprised of the Materials Supplier and the Installer, shall commence upon final acceptance of the roof system by the Owner. There shall be no time within the twenty (20) year warranty period that either party is exempt from full responsibility of the specified conditions of the warranty.

Should either party (Materials Supplier or Installer) for any reason fail to, or become incapable of honoring the specified warranty, the other party shall become wholly and solely responsible for honoring the full extent of the specified warranty for the balance of the twenty (20) year period.

1.04 PERFORMANCE TESTING REQUIREMENTS:

- A. Structural Tests: Structural designs shall have been derived from witnessed tests per ASTM E-72 "Chamber Method" using a 30 psf windload. A deflection limit of L/180 shall apply to positive load only.
- B. Submit shop drawings and calculations on structural design, preformed metal roof deck and fasteners that are signed, sealed and dated by a Professional Engineer registered in the State of Florida, verifying that the structural framing and covering panel connections meet loading

SECTION 074113 - PREFORMED WALL AND ROOF PANELS (continued):

requirements and codes and that they are in compliance with requirements to resist wind uplift, in accordance with ASCE 7-22. The design wind speed at the Remodeled part of the building shall have a $V_{ult} = 200$ mph; see Sheet S0.1 for the required Components & Cladding pressures.

- C. Air Infiltration: When tested per ASTM E-283-73 at a static pressure of 30 psf there shall not exceed .083 cfm per square foot of wall area.
- D. Water Penetration: When tested per ASTM E-331-70 at a static pressure of 30 psf there shall be no uncontrolled water penetration through the panel joints.
- E. Fire Tests: Panels shall be qualified by full scale fire tests for acceptance by building code and insurance authorities for use when non-load bearing non-combustible wall construction is permitted, based on fire performance. Evidence of the fire performance shall be submitted and include the following:
 - 1. UL1 classification for "Surface Burning Characteristics" per UL1 Standard 723 (ASTM E-84). Assembled Panel Units: Flame Spread less than 25. Smoke Developed less than 450.
 - 2. UL1 classification for "Enclosed Room Corner Test" (8' x 12' x 8'), per UL1 subject 1715.
 - 3. FM approved per FM Standards (4880), Full Scale Corner Test."
- F. All roofing materials shall be labeled Class A per ASTM E 108 and shall be certified by a nationally recognized, independent testing laboratory. All roofing systems shall be installed within the limitations of the test procedure for surfacing, deck cross slope and combustibility.

PART 2 - PRODUCTS

2.01 ACCEPTABLE ROOFING MANUFACTURER:

- A. **Manufacturer:** Provide the following pre-fabricated, pre-finished aluminum metal roof panel and components, including metal roof panels, underlayment, sliding clips, and other attachments, as manufactured by MBCI OR equal roof assembly. Comply with the following.

Metal paneling: Superlok, 22 ga. steel (0.023 inch), 16 inches wide

Insulation: R-30 Isocyanurate

Underlayment: per spec 071326

Deck: 1.5 inch x 16 ga. B-Deck

2.02 PANEL DESIGN:

- A. No panel shall exceed 18" width.
- B. Exposed fasteners are to be kept to a minimum.
- C. Integral batten profile shall be used for roofing and siding.
- D. Match profile of Architectural Metal Systems - "Loc Seam 16" for roof panel and "Architectural II" for wall panel.
- E. **Panels are to be continuous with no laps.**

2.03 MATERIALS:

- A. Face sheet shall be 22 gage, AZ55 acrylic coated, hot dipped (galvalume) aluminum-zinc alloy coated steel conforming to ASTM A792 Grade 40, commercial quality.
- B. All components used shall be approved by the manufacturer.

SECTION 074113 - PREFORMED WALL AND ROOF PANELS (continued):

- C. Flexible Closure Strips: Closed-cell, expanded cellular rubber, self-extinguishing, cut or premolded to match corrugation of roofing sheets. All neoprene closures shall be covered with metal profile closure to match color of roofing.
- D. Trim shall be formed sheet metal finished to match panels. Provide manufacturer's standard extruded aluminum trim painted to match panels if so detailed on Drawings.
- E. All exposed fasteners shall be made of stainless steel, cast aluminum-zinc alloy or capped head used with neoprene coated aluminum. Finish shall match color of roof panel.
- F. Sealants shall be:
 - 1. Preformed tape sealant shall be polymeric, butyl based material that is non-skinning, non-drying, non-toxic and shall have a service temperature range of -60°F to 212°F.
 - 2. Field applied vapor sealant in the panel joints shall be butyl based material that is non-skinning, non-drying, re-sealable and shall have a service temperature range of -60°F to 212°F.
 - 3. Field applied weather sealant shall be a silicone based material with excellent adhesion and cohesion properties and shall have a service temperature range of -80°F to 300°F.
- G. Roof panel clips shall be heavy gauge galvalume steel and concealed in the panel joint. The clips shall be installed from the topside of the roof.
- H. Sheet Metal Accessories:
 - 1. Gutters: Continuous roll formed, seamless gutters with end pieces, outlet tubes, and other special pieces. Size in accordance with SMACNA. Join sections with riveted and soldered or sealed joints. Provide expansion-type slip joint at center of runs. Furnish gutter supports 36 inches on center, constructed of same metal as gutters. Provide aluminum wire ball strainers at outlets. Gutters shall be 24 gage (galvalume coated) steel with an acrylic coating to match roof fascia and rake. Contractor to provide typical ADS downspout adapters and ADS piping as required to connect with existing system.
 - 2. Downspouts: Form in 10-foot sections with elbows and offsets. Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts 1 inch away from walls; locate fasteners at top and bottom and approximately 5 feet on center in between. Downspouts shall be 24 gage (galvalume coated) steel with an acrylic coating to match wall panels.
 - 3. Soffits: 22 gauge, (galvalume coated) steel soffits with an acrylic coating. Provide 8 1/2" wide panels. Perforated panels are required as shown on drawings. All fasteners shall be concealed. Profile to match Flexloc by MBCI.

PART 3 - EXECUTION

3.01 Inspection:

- A. Examine alignment of structural steel and/or panel support system prior to installation and do not proceed until any defects are corrected by the responsible contractor.
- B. Building tolerances shall not exceed maximums as defined by AISC or ACI specifications.
- C. The roof membrane shall be inspected by the manufacturer's representative within one (1) year of acceptance by the Owner.

3.02 INSTALLATION:

- A. Install metal panels, clips, fasteners, trim and related sealants in accordance with approved shop drawings and as may be required for a weathertight installation. Panels shall be cut in the field for bevels and openings. Flashing and trim shall be installed true and in proper alignment for best appearance. Sealants shall be installed without skips or voids to insure weathertightness and

SECTION 074113 - PREFORMED WALL AND ROOF PANELS (continued):

integrity of the vapor barrier system.

- B. All new installed material shall be sealed from moisture penetration at the end of each day. The contractor shall provide the architect with a 'final statement of compliance' for the owner's record.
- C. Remove all strippable coating if utilized, and provide a dry wipe-down cleaning of the panels as they are erected.

3.03 DAMAGED MATERIAL:

Upon determination of responsibility, repair or replace damaged metal panels and trim to the satisfaction of the Architect and/or the Owner.

SECTION 074113 - PREFORMED WALL AND ROOF PANELS (continued):

MANUFACTURER'S NOTICE OF INTENT TO ISSUE ROOF WARRANTY

Whereas _____ herein
called "Roofing Manufacturer" hereby gives to:

Owner: _____

Address: _____

of its Notice of Intent to Issue the Roof Warranty, as specified in the Contract Documents issued by Clemons
Rutherford & Associates.

Project: _____

Address: _____

When installed in accordance with manufacturer's instructions and the Contract Documents by a manufacturer
approved installer, certified to install the manufacturer's roofing system, identified as:

As the Authorized Representative of said Manufacturer, with the authority to make the above representations to the
Owner, I hereby certify the above statements to the Owner.

Manufacturer: _____

Address: _____

Authorized Representative: _____

Signed: _____

Date: _____

By submitting this bid I hereby certify to Owner that a manufacturer approved roofer will be installing the roofing
system.

Signed: _____

Date: _____

SECTION 074113 - PREFORMED WALL AND ROOF PANELS (continued):

METAL ROOFING GUARANTEE

WHEREAS, _____ of
(Roofing Contractor)

(Address)

AND WHEREAS _____ of
(Roofing Manufacturer)

(Address)

herein called "The Roofing Team" hereby gives notice to:

OWNER:

ADDRESS:

of having performed the metal roofing and related work on the project. More specifically:

PROJECT:

ADDRESS:

Date of Guarantee Acceptance:

Designated Guarantee Period: **Twenty Year Period**

Date of Guarantee Expiration:

AND WHEREAS, the Roofing Team have contracted, either directly with the Owner, or indirectly with each other for the benefit of the Owner to guarantee said work as follows for the designated guarantee period.

- A. The finish coating will not crack or check, peel, blister, flake, chip, or otherwise lose adhesion, and will not chalk in excess of eight (8), or fade in excess of five (5) ENBS units. Color change determination shall be made in accordance with ASTM D-2244, paragraph 4.3.2.4, by comparing exposed panels and unexposed panels from a given batch.
- B. Metal substrate shall not corrode or structurally fail within design loading conditions.
- C. Leak-Free.

SECTION 074113 - PREFORMED WALL AND ROOF PANELS (continued):

NOW THEREFORE, Roofing Team, defined as the material supplier and the installer, hereby guarantees, subject only to the terms, conditions and limitations herein set forth, that during guarantee period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of such work or materials as are necessary to correct defective workmanship or defective materials, and as are necessary to maintain said work during the guarantee period.

This guarantee is made subject to the following terms and conditions:

1. Specifically excluded from this guarantee are damages to the work caused by:
 - a. Penetrations of the roof associated with vents, equipment or other causes if performed without prior approval from the Roofing Team. Such approval will not be unreasonably withheld.
 - b. Failure of the building framing/structure in excess of design criteria.
 - c. Winds in excess of $V_{ult} = 200$ mph.
 - d. Lightning
 - e. Fires
 - f. Vandalism
 - g. Corrosive, aggressive atmosphere such as chemical fumes, direct salt spray (defined as being within 1500 feet of saltwater), or rain water and condensation which contains alkaline, acid, chlorides, or sulfates that is significantly above or below what is considered to be normal. By accepting the contract for installation of the roof, the panel manufacturer and installer declare that the atmospheric conditions, at the time of their bid, are within normal limits.
 - h. Hail
 - i. Other Acts of Gods.
2. When such work has been damaged by any of the foregoing causes, the guarantee shall be null and void until such damage has been repaired by the Roofing Team and until cost expense thereof has been paid by the Owner or by another responsible party so designated by the Owner.
3. The Roofing Team is responsible for any and all damage, deterioration, or failure for any reason of the work covered by this guarantee, except for those items specifically excluded above.
4. After reasonable investigation by the Owner, the Owner shall promptly notify Roofing Team of observed, known or suspected leaks, defects, or deterioration. The Roofing Team shall respond to all notifications within forty-eight (48) hours and to make all repairs as deemed reasonably necessary to correct said leaks or defects. Approval of such corrective work shall not be unreasonably withheld by the Owner.
5. In relation to the Weathertightness Warranty, the following shall apply. This guarantee shall not supersede any warranties or guarantee as a part of any construction or purchase contract between the Roofing Team and Owner, or any combination thereof, but shall operate in addition to all contractual guarantees and warranties available from the Roofing Team. This agreement shall not operate to restrict or cut off the Owner from any and all remedies and recourses lawfully available to him in cases of roofing failures. Specifically, this guarantee shall not operate to relieve Roofing Team of responsibility for performance of the original work in accordance with the requirements of contract directly with the Owner or a subcontract with the Owner's General Contractor. If any warranties or guaranties conflict, the most stringent in favor of the Owner shall take precedence. This warranty or guarantee does not cover any claims or actions for consequential, special, or

SECTION 074113 - PREFORMED WALL AND ROOF PANELS (continued):

incidental damages, or punitive damages, or other loss or expense, whether such claims may arise or be based upon tort (including negligence), strict liability contract or warranty, or any other cause of action, to the building, other property, contents or materials within the building project. Owner's exclusive remedy pursuant to this guarantee or warranty shall be the repair or replacement of the roof system materials as provided herein.

This joint warranty, comprised of the Materials Supplier and the Installer, shall commence upon final acceptance of the roof system by the Owner. There shall be no time within the twenty (20) year warranty period that either party is exempt from full responsibility of the specified conditions of the warranty.

Should either party (Materials Supplier or Installer) for any reason fail to, or become incapable of honoring the specified warranty, the other party shall become wholly and solely responsible for honoring the full extent of the specified warranty for the balance of the twenty (20) year period.

SECTION 074113 - PREFORMED WALL AND ROOF PANELS (continued):

By signing the above, the Authorized Representative of said entities certifies and represents that he is an officer of the entity with the authority to contract and make the above representations to the Owner.

IN WITNESS HEREOF, this instrument has been duly executed on this

day of , 20 .

(SEAL)

ROOFING CONTRACTOR

(Authorized Representative)

Sworn to and subscribed before me

this day of , 20 .

Notary Public

My commission expires:

(SEAL)

ROOFING MANUFACTURER

(Authorized Representative)

Sworn to and subscribed before me

this day of , 20 .

Notary Public

My commission expires:

SECTION 076200 - FLASHING & SHEET METAL

PART 1 - GENERAL

- 1.01 Conform to profiles and sizes shown on drawings and comply with "Architectural Sheet Metal Manual" by SMACNA, for each general category of work required.

Metal flashing and counter flashing.

- 1.02 Guarantee: Five-year maintenance guarantee stating that all work in this section not guaranteed under the roof warranty, will remain watertight for a period of 5-years from the date of project acceptance, co-signed by the General Contractor.

PART 2 - PRODUCTS

- 2.01 Solder: For use with steel or copper, provide 50-50 tin/lead solder (ASTM B 32), with rosin flux.
- 2.02 Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
- 2.03 Bituminous Coating: SSPC-Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
- 2.04 Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Section 07900 - Joint Sealers.
- 2.05 Epoxy Seam Sealer: 2-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior nonmoving joints including riveted joints.
- 2.06 Reglets: Metal or plastic units of type and profile indicated, compatible with flashing indicated, noncorrosive.
- 2.07 Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.
- 2.08 Mill Finish Aluminum: ASTM B 209, 3003-H14, with a minimum thickness of 0.040 inch, unless otherwise indicated.
- 2.09 Fabricated Units

Fabricate sheet metal with flat-lock seams; solder with type solder and flux recommended by manufacturer, except seal aluminum seams with epoxy metal seam cement and, where required for strength, rivet seams and joints.

Provide for thermal expansion of running sheet metal work by overlaps of expansion joints in fabricated work. Where required for water-tight construction, provide hooked flanges filled with polyisobutylene mastic for 1-inch embedment of flanges. Space joints at intervals of not more than 50 feet for steel, 24 feet for copper or stainless steel, or 30 feet for zinc alloy or aluminum. Conceal expansion provisions where possible.

PART 3 - EXECUTION

- 3.01 Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

SECTION 076200 - FLASHING AND SHEET METAL (continued):

- A. Coat side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - B. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
 - C. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- 3.02 Anchor work in place with noncorrosive fasteners, adhesives, setting compounds, tapes and other materials and devices as recommended by manufacturer of each material or system. Provide for thermal expansion and building movements. Comply with recommendations of "Architectural Sheet Metal Manual" by SMACNA.
- 3.03 Seal moving joints in metal work with elastomeric joint sealants, complying with requirements specified in Division 7 Section "Joint Sealants."
- 3.04 Clean metal surfaces of soldering flux and other substances which could cause corrosion.
- 3.05 Nail flanges of expansion joint units to substrates at spacing of 6 inches o.c.
- 3.06 Composition Stripping: Cover flanges (edges) of work set on bituminous substrate with 2 courses of glass fiber fabric (ASTM D-1668) set in and covered with asphaltic roofing cement.
- 3.07 Performance: Water-tight and weatherproof performance of flashing and sheet metal work is required.

END OF SECTION 076200

SECTION 078400 - FIRESTOPPING

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Firestopping of Through Penetrations in Rated Assemblies.
- B. Fire Resistive Joint Systems.
- C. Perimeter Fire Containment Systems.
- D. Smoke Seals.
- E. Construction enclosing compartmentalized areas.

1.02 RELATED SECTIONS

- A. Section 01 25 13 – Product Substitution Procedures.
- B. Section 01 33 00 – Submittal Procedures.
- C. Section 01 42 00 – References.
- D. Section 01 45 00 – Quality Control.
- E. Section 01 66 00 – Project Storage and Handling Requirements.
- F. Section 01 78 00 – Closeout SubmittalsSection 10 42 00 – References.
- G. Section 03 30 00 - Cast-In-Place Concrete: Sleeves and blockouts in concrete assemblies.
- H. Section 04 80 00 - Masonry Assemblies: Sleeves and blockouts in masonry assemblies.
- C. **Section 05 50 00** - Metal Decking.
- D. Section 05 81 10 - Architectural Joint Systems.
- E. Section 07 21 00 - Building Insulation.
- F. Section 07 71 60 - Roof Expansion Assemblies.
- G. Section 07 81 00 - Applied Fireproofing.
- H. Section 07 84 10 - Duct Firestopping: Fire resistive duct enclosures.
- I. Section 07 90 00 - Joint Sealers.
- J. Section 09 25 00 - Gypsum Board.
- K. Division 23 – Heating, Ventilating and Air Conditioning (HVAC): Work requiring firestopping.
- L. Division 26 - Electrical: Electrical work requiring firestopping.

1.03 REFERENCES

- A. See Section 01 42 00 – References for standards, rules, regulations and statutes applicable to this section.

1.04 PERFORMANCE REQUIREMENTS

- A. Provide products that upon curing, do not re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during and after construction.
- B. Provide firestop sealants sufficiently flexible to accommodate motion such as pipe vibration, water hammer, thermal expansion and other normal building movement without damage to seal.
- C. Pipe insulation shall not be removed, cut away or otherwise interrupted through wall or floor openings. Provide products appropriately tested for thickness and type of insulation utilized.
- D. Openings within walls and floors designed to accommodate voice, data and video cabling shall be provided with re-enterable products specifically designed for retrofit.
- E. Penetrants passing through fire-resistance rated floor-ceiling assemblies contained within chase wall assemblies shall be protected with products tested by being fully exposed to fire outside of chase wall. Systems within UL Fire Resistance Directory that meet criterion are identified with words "Chase Wall

SECTION 078400 – FIRESTOPPING (continued):

Optional".

- F. Provide fire-resistive joint sealants sufficiently flexible to accommodate movement such as thermal expansion and other normal building movement without damage to seal.
- G. Provide fire-resistive joint sealants designed to accommodate specific range of movement and tested for purpose in accord with cyclic movement test criteria as outlined in Standards, ASTM E-1399, ASTM E-1966 or ANSI/ UL 2079.
- H. Provide through penetration firestop systems and fire-resistive joint systems and conduct air leakage test in accord with Standards, ANSI/UL1479 and ANSI/ UL2079, respectively, with published L-Ratings for ambient and elevated temperatures as evidence of ability of through penetration firestop system or fire-resistive joint system to restrict movement of smoke.

1.05 SUBMITTALS

- A. Submit in accord with Section 01 33 00 – Submittal Procedures.
- B. Product Data: Provide manufacturer's standard catalog data for specified products demonstrating compliance with referenced standards and listing numbers of systems in which each product is to be used.
- C. Shop Drawings: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- D. Certificates:
 - 1. Product certificates signed by the firestop system manufacturer certifying material compliance with applicable code and specified performance characteristics.
 - 2. Certification of Installer's Qualifications.
- E. Installation Instructions: Submit manufacturer's printed installation instructions.

1.06 QUALITY ASSURANCE

- A. Products/Systems: Provide firestopping systems that comply with following requirements and as specified in Paragraph 1.04 - Performance Criteria.
 - 1. Firestopping tests shall be performed by qualified, testing and inspection agency, UL approved, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 - 2. Firestopping products bear classification marking of qualified testing and inspection agency.
- B. Installer Qualifications: Experienced in performing work, certified, licensed or otherwise qualified by firestopping manufacturer as having required training to install firestop products in accord with specified requirements.
- C. Mock-Up: Install mock-up using acceptable products and manufacturer approved installation methods.
 - 1. Apply one of each unit type of firestopping material, such as penetrations through fire rated partition, to representative application.
 - 2. Locate where directed.
 - 3. Maintenance: Maintain mock-up during construction for workmanship comparison.
 - 4. Remove and legally dispose of mock-up when no longer required.
- D. Preinstallation Meetings: Conduct meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and warranty requirements. Comply with Division 1 requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Delivery in manufacturer's original, unopened, undamaged containers, identification labels intact identifying product and manufacturer, date of manufacture; lot number; shelf life, if applicable;

SECTION 078400 – FIRESTOPPING (continued);

qualified testing and inspection agency's classification marking; and mixing instructions for multicomponent materials.

- B. Handle and store products in accord with manufacturer's written recommendations published in technical materials. Leave products wrapped or otherwise protected and under clean and dry storage conditions until required for installation.
- C. Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1.08 PROJECT CONDITIONS

- A. Do not install firestopping products when ambient or substrate temperatures are outside limitations recommended by manufacturer.
- B. Do not install firestopping products when substrates are wet due to rain, frost, condensation, or other causes.
- C. Maintain minimum temperature before, during, and for minimum 3 days after installation of materials
- D. Do not use materials that contain flammable solvents.
- E. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- F. Coordinate sizing of sleeves, openings, core-drilled holes or cut openings to accommodate through-penetration firestop systems.
- G. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.
- H. Schedule installation of safing materials in linear opening at curtain wall prior to construction that limits access to safing slot.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Specified Technologies Inc., 200 Evans Way; Somerville, NJ 08876; Tel: 800-992-1180; Tel: 908-526-8000; Fax: 908-526-9623; Website: www.stifirestop.com.
- B. Requests for substitutions will be considered in accord Section 01 25 13 – Product Substitution Procedures.
- C. Single Source: Obtain firestop systems for each type of penetration or joint opening and construction condition indicated only from single manufacturer.

2.02 MATERIALS

- A. Use only firestopping products that have been tested for specific fire-resistance-rated construction conditions conforming to construction assembly type, penetrating item type or joint opening width and movement capabilities, annular space requirements, and fire-rating involved for each separate instance.
- B. Latex Sealants: STI SpecSeal Series single component latex formulations that upon cure do not re-emulsify during exposure to moisture, the following products are acceptable:
 - 1. Specified Technologies, Inc. (STI) SpecSeal Series SSS Intumescent Sealant.
 - 2. Specified Technologies, Inc. (STI) SpecSeal Series LCI Intumescent Sealant.
 - 3. Specified Technologies, Inc. (STI) SpecSeal Series LC Endothermic Sealant.
 - 4. Specified Technologies, Inc. (STI) SpecSeal Series AS Elastomeric Spray.
 - 5. Specified Technologies, Inc. (STI) SpecSeal Series ES Elastomeric Sealant.

SECTION 078400 – FIRESTOPPING (continued):

- C. Firestop Devices: STI SpecSeal Series factory-assembled steel collars lined with intumescent material sized to fit specific outside diameter of penetrating item, the following products are acceptable:
 - 1. Specified Technologies, Inc. (STI) SpecSeal Series SSC Firestop Collars.
 - 2. Specified Technologies, Inc. (STI) SpecSeal Series LCC Firestop Collars.
- D. Wall Opening Protective Materials: STI SpecSeal Series intumescent, non-curing pads or inserts for protection of electrical switch and receptacle boxes to reduce horizontal separation to less than 24 inches (610mm), the following products are acceptable:
 - 1. Specified Technologies, Inc. (STI) SpecSeal Series SSP Firestop Putty Pads.
 - 2. Specified Technologies, Inc. (STI) SpecSeal Series EP PowerShield Insert Pads.
- E. Firestop Putty: STI SpecSeal Series intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds, the following products are acceptable:
 - 1. Specified Technologies, Inc. (STI) SpecSeal Series SSP Firestop Putty.
- F. Fire Rated Cable Pathways: STI EZ-PATH device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:
 - 1. Specified Technologies Inc. (STI) EZ-PATH Fire Rated Pathway.
- G. Wrap Strips: STI SpecSeal Series single component intumescent elastomeric strips faced on both sides with a plastic film, the following products are acceptable:
 - 1. Specified Technologies, Inc. (STI) SpecSeal Series RED Wrap Strip.
 - 2. Specified Technologies, Inc. (STI) SpecSeal Series BLU Wrap Strip.
 - 3. Specified Technologies, Inc. (STI) SpecSeal Series BLU2 Wrap Strip.
- H. Firestop Pillows: STI SpecSeal Series re-enterable, non-curing, mineral fiber core encapsulated with an intumescent coating contained in a flame retardant poly bag, the following products are acceptable:
 - 1. Specified Technologies, Inc. (STI) SpecSeal Series SSB Firestop Pillows.
- I. Mortar: STI SpecSeal Series Portland cement based dry-mix product formulated for mixing with water at Project site to form a non-shrinking, water-resistant, homogenous mortar, the following products are acceptable:
 - 1. Specified Technologies, Inc. (STI) SpecSeal Series SSM Firestop Mortar.
- J. Silicone Sealants: STI SpecSeal Series moisture curing, single component, silicone elastomeric sealant for horizontal surfaces (pourable or nonsag) or vertical surface (nonsag), the following products are acceptable:
 - 1. Specified Technologies, Inc. (STI) Pensil 300 Silicone Sealant.
 - 2. Specified Technologies, Inc. (STI) Pensil 300 SL Self-Leveling Silicone Sealant.
- K. Silicone Foam: STI SpecSeal Series multicomponent, silicone-based liquid elastomers, that when mixed, expand and cure in place to produce a flexible, non-shrinking foam, the following products are acceptable:
 - 1. Specified Technologies, Inc. (STI) Pensil 200 Silicone Foam.
- L. Silicone/Urethane Sealants: STI SpecSeal Series moisture curing, single component, silicone/urethane hybrid elastomeric sealant for horizontal surfaces, the following products are acceptable:
 - 1. Specified Technologies, Inc. (STI) SpecSeal Fast Tack Firestop Spray.
- M. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

SECTION 078400 – FIRESTOPPING (continued):

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Before beginning installation, verify that substrate conditions previously installed under other sections are acceptable for installation of firestopping in accord with manufacturer's installation instructions and technical bulletins.
- B. Surfaces shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.
- C. Provide masking and temporary covering to protect adjacent surfaces.
- D. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Install through-penetration firestop systems and fire-resistive joint systems in accordance with the Performance Criteria and in accord with conditions of testing and classification as specified in published design.
- B. Manufacturer's Instructions: Comply with manufacturer's written instructions for installation of firestopping products and the following.
 - 1. Seal openings or voids made by penetrations to ensure air and water resistant seal.
 - 2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of through-penetration firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
 - 3. Protect materials from damage on surfaces subjected to traffic.
 - 4. Apply suitable bond-breaker to prevent three-sided adhesion in applications where conditions might occur such as intersection of gypsum wallboard/steel stud wall to floor or roof assembly where joint is backed by steel ceiling runner or track.
 - 5. Where joint application is exposed to elements, fire-resistive joint sealant must be approved by manufacturer for use in exterior applications and shall comply with ASTM C-920, "Specification for Elastomeric Joint Sealants".

3.03 FIELD QUALITY CONTROL

- A. Keep areas of work accessible until inspection by authorities having jurisdiction.
- B. Where deficiencies are found, repair or replace firestopping products to comply with requirements.

3.04 ADJUSTING AND CLEANING

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- B. Clean all surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling as work progresses.

END OF SECTION 078400

SECTION 079200 - JOINT SEALERS

PART 1 - GENERAL

- 1.01 **PRECONSTRUCTION FIELD TESTS:** Prior to installation of joint sealers, field-test their adhesion to joint substrates per field adhesion test in AAMA Aluminum Curtain Wall Series No. 13.
- 1.02 **SUBMITTALS:** Submit product data, samples of each type and color of joint sealer required and certified test reports for joint sealers evidencing compliance with requirements.
- 1.03 **COMPATIBILITY:** Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under service and application conditions, as demonstrated by testing and field experience.
- 1.04 **COLORS:** Provide color of exposed joint sealers to match color of adjacent surface.

PART 2 - PRODUCTS

- 2.01 **ELASTOMERIC SEALANT STANDARD:** Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated, complying with ASTM C 920 requirements.
 - A. **One-Part Nonacid-Curing Silicone Sealant:** Type S, Grade NS, Class 25, Uses NT, M, G, A, and O. Additional capability, when tested per ASTM C 719, to withstand 35 percent movement in both extension and compression for a total of 70 percent movement as measured at time of application and still comply with other requirements of ASTM C 920.
 - B. **One-Part Nonsag Urethane Sealant for Use NT:** Type S; Grade NS; Class 25; and Uses NT, M, A, and O.
- 2.02 **ACRYLIC SEALANT:** Manufacturer's standard one-part nonsag, solvent-release-curing, acrylic terpolymer sealant complying with ASTM C 920 for Type S; Grade NS; Uses NT, M, G, A and O; except for selected test properties which are revised as follows:
 - Heat-aged hardness: 40-50
 - Weight loss: 15 percent
 - Max. cyclic movement capability: plus or minus 7.5 percent
- 2.03 **SILICONE-EMULSION SEALANT:** Manufacturer's standard one part, nonsag, mildew-resistant, paintable, silicone-emulsion sealant complying with ASTM C 834.
- 2.04 **ACOUSTICAL SEALANT FOR CONCEALED JOINTS:** Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.
- 2.05 **FIRESTOP CAULKING AND PUTTY:** Provide Firestop Putty or Adhesive Firestop Caulking/Sealant for fire sealing rated partitions at penetrations, junctions with roofing panels, and intersections at dissimilar materials. Firestop putty shall be Nelson FSP Firestop Putty as manufactured by Hevi-Duty/Nelson, **OR** Approved Equal. Adhesive Firestop caulking/sealant shall be Nelson CLK Adhesive Firestop Sealant as manufactured by Hevi-Duty/Nelson, **OR** Approved Equal. Materials furnished for firestopping shall comply with ASTM E-84 and ASTM E-814. Comply with manufacturer's instructions for installation and suitability for application.
- 2.06 **FOAMED-IN-PLACE FIRE-STOPPING SEALANT:** Two-part, foamed-in-place, silicone sealant for use as part of a through-penetration fire-stop system for filling openings around cables, conduit, pipes and similar penetrations through walls and floors, with fire-resistance rating indicated, per ASTM E 814; listed by UL or other testing and inspecting agency acceptable to authorities having jurisdiction.

SECTION 079200 - JOINT SEALERS (continued):

- 2.07 **ONE-PART FIRE-STOPPING SEALANT:** One part elastomeric sealant formulated for use as part of a through-penetration fire-stop system for sealing openings around cables, conduit, pipes and similar penetrations through walls and floors, listed by UL or other testing and inspecting agency acceptable to authorities having jurisdiction.
- 2.08 **SEALANT BACKINGS, GENERAL:** Nonstaining; compatible with joint substrates, sealants, primers and other joint fillers; approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- A. **Elastomeric Tubing Joint-Fillers:** Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, capable of remaining resilient at temperatures down to -26 deg F (-15 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth and otherwise contribute to optimum sealant performance.
- B. **Bond-Breaker Tape:** Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing bond between sealant and joint filler or other materials at back of joint.
- 2.09 **PRIMER:** As recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated.
- 2.10 **ACCESSORY MATERIALS FOR FIRE-STOPPING SEALANTS:** Forming, joint-fillers, packing and other accessory materials as required for installation of fire-stopping sealants.

PART 3 - EXECUTION

- 3.01 **GENERAL:** Comply with joint sealer manufacturers' instructions applicable to products and applications indicated.
- 3.02 **INSTALLATION:**
- A. **Elastomeric Sealant Installation Std:** Comply with ASTM C 962.
- B. **Latex Sealant Installation Standard:** Comply with ASTM C 790.
- C. **Acoustical Sealant Application Standard:** Comply with ASTM C 919 for use of joint sealants in acoustical applications.
- D. **Installation of Fire-Stopping Sealant:** Install sealant, including forming, packing and other accessory materials to fill openings around mechanical and electrical services penetrating floors and walls to provide fire-stops with fire resistance ratings indicated.
- E. **Protect Precast concrete panel joints** in accordance with one of the following:
1. For wall panels 6 inches in thickness or greater where the joint is a maximum of ¾ inches in width and sealed on each face with a Type S joint material in accordance ASTM C920. The panel thickness shall be measured perpendicular to the joint and at 1 inch or less from the joint center.
 2. For roof panels 4 inches in thickness or greater where the joint is a maximum of ¾ inches and sealed with a Type S joint material in accordance with ASTM C920. The panel thickness shall be measured perpendicular to the joint and at 1 inch or less from the joint center.

END OF SECTION 079200

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SECTION 080500 - DOOR SCHEDULE NOTES:

DOOR SCHEDULE LEGEND

<u>ABBREVIATION</u>	<u>DEFINITION</u>
AL	ALUMINUM
ANOD	ANODIZED
HM	HOLLOW METAL
PR	PAIR OF DOORS
PT	PAINT
ST	STAIN
MTL	METAL
S	SMOKE DOOR (TO MEET UL 1784 AND TO HAVE CLOSER AND ARTIFICIAL BOTTOM SEAL INSTALLED ACROSS THE FULL WIDTH OF THE BOTTOM OF THE DOOR ASSEMBLY)
STL	STEEL
WD	WOOD
Manf.	MANUFACTURER
UC	UNDER CUT
20 MIN	20 MINUTE FIRE-RATED DOOR AND FRAME ASSEMBLY.
45 MIN	45 MINUTE FIRE-RATED DOOR AND FRAME ASSEMBLY.
90 MIN.	1 1/2 HOUR FIRE-RATED DOOR AND FRAME ASSEMBLY.

END OF SECTION 080500

SECTION 080500 - DOOR SCHEDULE NOTES:

GENERAL NOTES:

1. See Sheets A7.1 for Frame Elevations and details.
2. See Mechanical Drawings for location of undercut doors. Maximum undercut to be 3/4".
3. All doors are to be 1-3/4" thick unless otherwise noted.
4. All hardware shall have lever type handles.
5. All doors in the means of egress shall be operable from the inside without special key effort or knowledge.
6. Folding door hardware shall be operable by a force of not more than five (5) pounds when folding doors are fully open. Operating hardware shall be exposed and useable from both sides.
7. See Section 101440 - Signage for sign types.
8. All rated door assembly hardware butts to be ball bearing.
9. Use tempered glass in all doors with lites and sidelites, except at fire rated doors.
10. All rated doors shall be positively latched.
11. Use fire rated glazing in all fire rated doors with lites and sidelites.
12. Exterior Doors, Frames & Hardware to meet FEMA P-361 & ICC 500 wind speeds, pressures & Missile Impact criteria for a Hurricane Safe Room.

REMARKS:

1. See Sheet LS1.0 for Maximum Occupancies Capacities.

SECTION 081113 – HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Steel doors
- B. Steel frames
- C. Steel architectural stick systems

1.02 RELATED SECTIONS

- A. Section 08210 - Wood Doors
- B. Section 08710 - Door Hardware
- C. Section 08800 - Glazing
- D. Section 09900 - Paints and Coatings
- E. Section 13710 - Intrusion Detection: **Security** system
- F. Section 13800 - Building Automation and Control: Building monitoring system
- G. Section 16123 - Building Wire and Cable: Power supply to electric hardware devices

1.03 REFERENCES

- A. ASTM - American Society for Testing and Materials
 - 1. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM A 924 - Specification for General Requirements for Steel Sheet, Metallic Coated by the Hot Dip Process.
 - 3. ASTM A 1008/A 1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, High Strength Low-Alloy, High Strength Low Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
 - 4. ASTM E 90 - Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
 - 5. ASTM E 413 - Classification for Rating Sound Insulation.
- B. ANSI - American National Standards Institute
 - 1. ANSI/DHI A115 - Specifications for Hardware Preparations in Standard Steel Doors and Frames.
 - 2. ANSI/DHI A115.IG - Installation Guide for Doors and Hardware.
 - 3. ANSI A156.7 - Hinge Template Dimensions.
 - 4. ANSI A 250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Painted Steel Surfaces for Steel Doors and Frames.
 - 5. ANSI A250.4 – Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing.
 - 6. ANSI A 250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames.
 - 7. ANSI A 250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
 - 8. ANSI/SDI 250.11 - Recommended Erection Instructions for Steel Frames
- C. SDI - Steel Door Institute
 - 1. SDI 105 - Recommended Erection Instructions for Steel frames.
 - 2. SDI 111 - Recommended Details and Guidelines for Standard Steel Doors and Frames and Accessories.
 - 3. SDI 112 - Zinc-Coated (Galvanized/Galvannealed) Standard Steel Doors and Frames.

SECTION 08110 - STEEL DOORS AND FRAMES

4. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.
 5. SDI 118 - Basic Fire Door Requirements.
 6. SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
 7. SDI 124 - Maintenance of Standard Steel Doors and Frames.
- D. NAAMM/HMMA - Hollow Metal Manufacturers Association
1. HMMA 840 - Guide Specification for Installation and Storage of Hollow Metal Doors and Frames
 2. HMMA 820 TN01- Grouting Hollow Metal Frames
 3. HMMA 820 TN03 – Guidelines for Glazing of Hollow Metal Transom, Sidelight and Windows
- E. Building Code references
1. NFPA 80 - Standard for Fire Doors and Other Opening Protective's.
 2. NFPA 105 - Standard for the Installation of Smoke Door Assemblies and Other Opening Protective's
 3. NFPA 252 – Standard Method of Fire Tests of Door Assemblies
 4. ANSI/UL 10C - Standard for Safety for Positive Pressure Fire Tests of Door Assemblies
 5. UL 1784 - Air Leakage Tests of Door Assemblies
 6. UL - Building Materials Directory; Underwriters Laboratories Inc
 7. WH - Certification Listings; Warnock Hersey International Inc.
 8. Federal Emergency Management Agency (FEMA) 361 Guidelines
 9. Miami - Dade County test protocols PA 201, PA 202 and PA 203.
 10. Florida Building Code test protocols TAS 201, TAS 202 and TAS 203
 11. **IBC ICC500**

1.04 REQUIREMENTS OF REGULATORY AGENCIES:

- A. Doors and frames: conform to applicable codes for fire ratings. It is the intent of this specification that door hardware and its application comply or exceed the standards for labeled openings. In case of conflicts in required fire protection ratings, provide fire ratings as required by NFPA and UL.
1. Fire door assemblies in exit enclosures and exit passageways: maximum transmitted temperature end point of not more than 250°F (121°C) above ambient at the end of 30 minutes of the standard fire test exposure.

1.05 SUBMITTALS

- A. Submit for review six (6) complete copies of the hollow metal shop drawings covering complete identification of items required for the project. Include manufacturer's names and identification of product. Included six (6) complete copies of catalog cuts and/or technical data sheets and other pertinent data as required to indicate compliance with these specifications.
1. Shop Drawings: submit complete and detailed with respect to quantities, dimensions, specified performance, and design criteria, materials and similar data to enable the Architect to review the information as required.
- B. Indicate frames configuration, anchor types and spacing, location of cutouts for hardware, reinforcement, to ensure doors and frames are properly prepared and coordinated to receive hardware.
- C. Indicate door elevations, internal reinforcement, closure method, and cutouts for glass lights and louvers.
- D. Submit manufacturer's installation instructions, including a current copy of ANSI A250.11 as part of the shop drawing submittal.

SECTION 08110 - STEEL DOORS AND FRAMES

- E. Shop drawings, product data, and samples: stamp with Contractor's stamp verifying they have been coordinated and reviewed for completeness and compliance with the contract documents.
- F. Shop drawings submitted without the above requirements will be considered incomplete, will NOT be reviewed, and will be returned directly to the Contractor.
- G. Follow the same procedures for re-submittal as the initial submittal with the appropriate dates revised.
- H. Provide evidence of manufacturer's membership in the Steel Door Institute.

1.06 QUALITY ASSURANCE

- A. Select a qualified hollow metal distributor who is a direct account of the manufacturer of the products furnished. In addition, that distributor must have in their regular employment an Architectural Hardware Consultant (AHC), a Certified Door Consultant (CDC) or an Architectural Openings Consultant (AOC), who will be available to consult with the Architect and Contractor regarding matters affecting the door and frame opening.
- B. Conform to requirements of the above reference standards. Submit test reports upon request by the Owner or Architect.
- C. Underwriters' Laboratories and Intertek Testing Services / Warnock Hersey, labeled fire doors and frames:
 - 1. Label fire doors and frames listed in accordance with Underwriters Laboratories standard UL10C, and Positive Pressure Fire Tests of Door Assemblies.
 - 2. Construct and install doors and frames to comply with applicable issue of ANSI/NFPA 80.
 - 3. Manufacture Underwriters' Laboratories labeled doors and frames under the UL factory inspection program and in strict compliance to UL procedures, and provide the degree of fire protection, heat transmission and panic loading capability indicated by the opening class.
 - 4. Manufacture Intertek Testing Services / Warnock Hersey labeled doors and frames under the ITS/WH factory inspection program and in strict compliance to ITS/WH procedures, and provide the degree of fire protection capability indicated by the opening class.
 - 5. Affixed physical label or approved marking to fire doors and/or fire door frames, at an authorized facility as evidence of compliance with procedures of the labeling agency. Labels to be metal, paper or plastic. Stamped or die cast labels are not permitted. Labels are not to be removed, defaced or made illegible while the door is in service as covered in NFPA Pamphlet 80.
 - 6. Conform to applicable codes for fire ratings. It is the intent of this specification that hardware and its application comply or exceed the standards for labeled openings. In case of conflict between types required for fire protection, furnish type required by NFPA and UL.
- D. Severe Storm Products:
 - 1. Exterior Doors: Door systems are required to comply with the ICC500 Product Approval and the project specific requirements noted on S0.1's Components and Cladding Table.
- E. Manufacturer Qualifications: Member of the Steel Door Institute.
- F. Installer: Minimum five years documented experience installing products specified in this Section.

SECTION 08110 - STEEL DOORS AND FRAMES

1.07 SAMPLES:

- A. If requested by the Architect, submit a 18" X 24" cut-away sample door with provisions for lockset, hinge and corner section of frame.
 - 1. Construct door sample to show vertical edge construction, top and bottom construction, insulation, face stiffeners, hinge, and other applied hardware reinforcements. Include louver sections and glazing stop where applicable.
 - 2. Construct frame sample to show frame profile, welded corner joint, welded hinge reinforcement, dust cover boxes, floor anchors and wall anchors. Include panel and louver sections and glazing stops where applicable.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Storage of Doors

- 1. Store doors vertically in a dry area, under proper cover. Place the units on at least 4" high wood sills on floors in a manner that will prevent rust and damage. Avoid storage in non-vented plastic or canvas shelters, which create a humidity chamber and promote rusting. If the door becomes wet, or moisture appears, remove protective wrapping immediately. Provide a 4" space between the doors to permit air circulation. Proper storage is required to meet the requirements of ANSI/SDI A250.10 and HMMA 840.

B. Storage of Frames

- 1. Store frames in an upright position with heads uppermost under cover on 4" wood sills on floors in a manner that will prevent rust and damage. Do not use non-vented plastic or canvas shelters, which create a humidity chamber and promote rusting. Store assembled frames in a vertical position, five units maximum in a stack. Provide a 2" space between frames to permit air circulation.
- 2. Provide proper storage for doors and frames, to maintain the quality and integrity of the factory applied paint, and maintain the requirements of ANSI/SDI A250.10 and HMMA 840.
- 3. Sand, touch up and clean prime painted surfaces prior to finish painting in accordance with the manufacturer's instructions.

1.09 COORDINATION

- A. Coordinate Work with other directly affected sections involving manufacture or fabrication of internal cutouts and reinforcement for door hardware, electric devices and recessed items.
- B. Coordinate work with frame opening construction, door and hardware installation.
- C. Sequence installation to accommodate required door hardware.
- D. Verify field dimensions for factory assembled frames prior to fabrication.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable manufacturers for doors and frames specified are listed below.

SECTION 08110 - STEEL DOORS AND FRAMES

1. Steelcraft, Cincinnati, Ohio

B. Provide steel doors and frames from a single manufacturer.

2.02 DOORS:

A. Construct exterior/interior doors to these designs and gages:

1. Exterior Doors: Zinc-Iron Alloy-Coated galvanized steel, ASTM A 653, Class A60, PW-Series 14 gage Zinc-Iron Alloy-Coated galvanized steel, with closed tops.
 - a. Include galvanized components and internal reinforcements with galvanized doors.
 - b. Close tops of exterior swing-out doors to eliminate moisture penetration. Galvanized steel top caps are permitted.
2. Interior Doors: Cold-rolled steel, A 1008, L-Series 18 gage
 - a. Include galvanized components and internal reinforcements with galvanized doors.
3. Factory prime painted doors indicated on door schedule as HM.
4. Hardware Reinforcements:
 - a. Hinge reinforcements for full mortise hinges: minimum 7 gage [0.180" (4.7mm)].
 - b. Lock reinforcements: minimum 16 gage [0.053" (1.3mm)].
 - c. Closer reinforcements: minimum 14 gage [0.067" (1.7mm)], 20" long.
 - d. Galvanized doors: include galvanized hardware reinforcements.
 - e. Projection welded hinge and lock reinforcements to the edge of the door.
 - f. Provide adequate reinforcements for other hardware as required.
5. Glass moldings and stops (both labeled and non-labeled doors):
 - a. Fabricate glass trim from 24 gage [.6mm] steel conforming to:
 1. Interior openings ASTM designation A 366 cold rolled steel
 2. Exterior openings Not Permitted Under FBC testing for ICC500
 - b. Install trim into the door as a four sided welded assembly with mitered, reinforced and welded corners.
 - c. Trim: identical on both sides of the door.
 - d. Exposed fasteners are not permitted. Labeled and non-labeled doors: use the same trim.
 - e. Acceptable mounting methods:
 1. Fit into a formed area of the door face, not extending beyond the door face, and interlocking into the recessed area
 2. Cap the cutout not extend more than 1/16" [1.6mm] from the door face.

B. Full Flush Type Doors Construction

1. ANSI-A250.4 criteria and tested to 5,000,000 operating cycles.
2. Approved door core constructions:
 - a. **Honeycomb:** Reinforced, stiffened, sound deadened and insulated with impregnated Kraft honeycomb core completely filling the inside of the doors and laminated to inside faces of both panels using contact adhesive applied to both panels and honeycomb core. Acceptable products:
 1. Steelcraft: **L Interior**
 - b. Paladin Doors Exterior per ICC500 - PW

SECTION 08110 - STEEL DOORS AND FRAMES

3. Vertical edge seams: Provide doors with continuous vertical mechanical inter-locking joints at lock and hinge edges with visible edge seams, or a one piece full height 14 gage channel. Apply a continuous bead of structural epoxy in the internal vertical connection.:
 - a. Welded Vertical Edges (W): Continuous vertical mechanical interlocking joint; edge seams welded, epoxy filled, and ground smooth.
 1. Steelcraft LW edge option
 4. Bevel hinge and lock door edges 1/8 inch (3 mm) in 2 inches (50 mm). Square edges on hinge and/or lock stiles are not acceptable.
 5. Reinforce top and bottom of doors with galvanized 14 gage, welded to both panels.
- C. Hurricane Doors: Designed to resist the cyclic pressures, static pressures and missile impact loads as detailed in the Miami-Dade County Product Control Approval System of the Florida Building Code Approval System and meets the requirements of Miami – Dade County test protocols PA 201, PA 202, PA 203 and Florida Building Code test protocols TAS 201, TAS 202 and TAS 203.

2.03 DOOR FRAMES:

- A. Construct exterior and metal door frames to these profiles, designs and gauges;
1. Exterior Frames: Zinc-Iron Alloy-Coated galvanized steel, ASTM A 653, Class A60, 14 gage
Interior Frames in Masonry: Zinc-Iron Alloy-Coated galvanized steel, ASTM A 653, Class A60, 16 gage [0.053" (1.3mm)] galvanized steel.
- B. Flush Frames: knocked down for field assembly or set-up and welded with temporary shipping bars. Factory die-mitered corner connections reinforced with four integral tabs to secure and interlock at jambs to head. Unless otherwise indicated, frame will have 2" faces and 5/8" stops. Frame depths per the architectural door schedule.
1. Provide frames with a minimum of six wall anchors and two adjustable base anchors of manufacturer's standard design. Acceptable products:
 - a. Steelcraft: F – Interior
 - b. Steelcraft PF – Exterior for ICC500
 2. Provide welded 3 sided frames as follows:
 - a. Full profile welded:
 1. Weld miter joints between head and jamb faces completely along their length either internally or externally.
 2. Internally weld perimeter profile joints full length of soffit and rabbets with hairline seams on external meeting surfaces. Grind and finish face joints smooth.
 - b. Weld-in base anchor attaching plate in each jamb for field installation of loose base anchors to allow proper anchoring at base of frame. Acceptable products:
 1. Steelcraft: DW
 - c. Dimpled holes and face screw application. Acceptable products:
 1. Steelcraft: K
 - b. Anchors for Exterior frames per Paladin Requirements for ICC500
- C. Prepare frames to receive inserted type door silencers (3) per strike jamb on single doors, and (2) per head for pair of doors. Stick-on silencers are not permitted.
- D. Frame Hardware Reinforcements

SECTION 08110 - STEEL DOORS AND FRAMES

:

1. Mortise hinge reinforcement: minimum 7 gage [0.180" (4.7mm)].
 - a. Provide high frequency hinge reinforcement for top hinge on all exterior, cross corridor, and stairwell frames, in accordance with SDI 111-H, Example "A" Application, where full mortise hinges are specified.
2. Strike reinforcements: minimum 16 gage [0.053" (1.3mm)] and prepared for an ANSI-A115.1-2 strike.
3. Closer reinforcement: minimum 14 gage [0.067" (1.7mm)] steel.
4. Projection weld hinge and strike reinforcements to the door frame.
5. Provide metal plaster guards for all mortised cutouts.
6. Provide adequate reinforcements for other hardware as required.
7. Include galvanized hardware reinforcements in all galvanized frames.

2.05 FABRICATION:

A. Face Welded Frames:

1. Continuous face weld the joint between the head and jamb faces along their length either internally or externally. Grind, prime paint, and finish smooth face joints with no visible face seams.
2. Externally weld, grind, prime paint, and finish smooth face joints at meeting mullions or between mullions and other frame members per a current copy of ANSI/SDI A250.8.
3. Provide two temporary steel spreaders (welded to the jambs at each rabbet of door openings) on welded frames during shipment. Remove temporary steel spreaders prior to installation of the frame.

2.06 FINISH:

- A. Doors, frames and frame components are required to be cleaned, phosphatized, and finished with one coat of baked-on rust inhibiting prime paint in accordance with the ANSI/SDI A250.10 "Test Procedures and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."

PART 3 EXECUTION:

3.01 INSTALLATION:

- A. Install doors and frames in accordance with Steel Door Institute's recommended erection instructions for steel frames ANSI A250.11.
- B. Install label doors and frames in accordance with NFPA-80.
- C. Remove temporary steel spreaders prior to installation of frames.
- D. Set frames accurately in position; plumb, align and brace until permanent anchors are set. After wall construction is complete, remove temporary wood spreaders.

SECTION 08110 - STEEL DOORS AND FRAMES

1. Field splice only at approved locations indicated on the shop drawings. Weld, grind, and finish as required to conceal evidence of splicing on exposed faces.
 2. Anchor's installed as per the Testing report details for quantity and location
- E. Provide full height 3/8" to 1-1/2" thick strip of polystyrene foam blocking at frames requiring grouting where continuous hinges are specified. Apply the strip to the back of the frame, where the hinge is to be installed, to facilitate field drilling or tapping.
- F. Where grouting is required in masonry, provide and install temporary bottom and intermediate wood spreaders to maintain proper width and avoid bowing or deforming of frame members. Refer to ANSI A250.11-2001, Standard.
1. Hollow Metal Frames to receive grouting: comply with a current copy of ANSI/SDI Standard A250.8, paragraph 4.2.2, whereby grout will be mixed to provide a 4" maximum slump consistency and hand troweled into place. Do not use grout mixed to a thinner, pumpable consistency; this practice is not recommended and not permissible. Refer to HMMA 820 TN01 Grouting Hollow Metal Frames.
- G. Provide a vertical wood brace during grouting of frame at openings over 4'0" wide, to prevent sagging of frame header.
- H. Glaze and seal exterior transom, sidelight and window frames in accordance with HMMA-820 TN03.
- I. Apply hardware in accordance with hardware manufacturers' instructions and Section 08710 FINISH HARDWARE of these Specifications. Install hardware with only factory-provided fasteners. Adjust door installation to provide uniform clearance at head and jambs, to achieve maximum operational effectiveness and appearance.

3.02 ADJUSTING:

- A. Final Adjustments: Adjust operating doors and hardware items just prior to final inspection and acceptance by the Owner and Architect. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames that are damaged, bowed or otherwise unacceptable.
- B. Prime Coat Touch-Up: Immediately after erection, sand smooth rusted or damaged areas of prime coat, and apply touch-up of compatible air-drying primer.

3.03 PROTECTION

- A. Provide protective measures required throughout the construction period to ensure that door and frame units will be without damage or deterioration, other than normal weathering, at time of acceptance.

3.04 INSPECTION

- A. Process for Inspection of concrete door post installed anchors:
1. Verify screw heads are installed per approved detail periodically including edge distance, and spacing distance prior to drywall installation.
 2. Observe the installation procedure at the beginning of installation. This is to verify proper construction technique and ability.

END OF SECTION

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

- 1.01 **QUALITY STANDARDS:** Comply with ANSI/WDMA I.S. 1-A
- 1.02 **SUBMITTALS:** In addition to product data, submit Samples 1'-0" square, of each type of core construction, face material and finish required.
- 1.03 **WARRANTY:** Provide manufacturer's life time of installation warranty for interior wood doors.

PART 2 - PRODUCTS

- 2.01 **APPROVED MANUFACTURERS & SERIES:** Subject to compliance with requirements, provide wood doors by one of the following:
 - Masonite - Algoma-Marshfield: Aspiro Series OR Approved Equal
- 2.02 **GENERAL WOOD DOOR PRODUCT REQUIREMENTS:** Provide doors with same exposed surface material on both faces of each door, unless otherwise indicated.
 - A. **Louvers:** Manufacturer's standard louvers of type, materials and size indicated:
 - 1. **Material:** Color anodized aluminum.
- 2.03 **INTERIOR SOLID CORE DOORS FOR TRANSPARENT FINISH:** As follows:
 - A. **Faces:** Natural Birch, plain sliced.
 - B. **Grade:** AA
 - C. **Veneer Leaf Match:** Slip match
 - D. **Veneer Face Match/Assembly:** Running
 - E. **Construction:** PC-5 (Particleboard core, 5-ply).
 - F. **Finish:** To be selected from manufacturer's select stain options.
 - G. **Metal Frames for Light Openings:** Manufacturer's standard 18-gage cold-rolled steel frame, **factory-primed, to be painted in field. Color to be selected by Architect.**
- 2.04 **INTERIOR FIRE-RATED SOLID CORE DOORS:** Labeled and listed for rating indicated, by testing and inspection agency acceptable to authorities having jurisdiction, complying with the following requirements:
 - A. **Faces and AWI Grade:** Match faces of non-rated doors in same area of building, unless otherwise indicated.
 - B. **Edge Construction:** Manufacturer's standard laminated edge construction for improved screw-holding capability and split resistance.
 - C. **Pairs:** Furnished formed steel edges and astragals for pairs of fire-rated doors, unless otherwise indicated.
 - D. **Metal Frames for Light Openings in Fire Doors:** Manufacturer's standard 18-gage cold-rolled steel frame, factory-primed, approved for use in door of fire-rating indicated.
 - E. All doors in stairwells shall be temperature rise doors.

SECTION 081416 - FLUSH WOOD DOORS (continued):

- F. Fire rated doors shall be labeled with a permanently affixed raised metal tag located on the hinge side of the door. Stenciled or paper labels shall not be used.
- 2.05 **FABRICATION:** Fabricate flush wood doors to produce doors complying with following requirements:
- A. **In sizes indicated** for job-site fitting.
 - B. **Metal Astragals:** Pre-machine astragals and formed steel edges for hardware where required for pairs of fire-rated doors.
 - C. **Openings:** Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of doors required.
 - 1. **Light Openings:** Trim openings with moldings of material and profile indicated.
 - D. **Louvers:** Factory install louvers in prepared openings.
- 2.06 **SHOP SEAL** faces and edges of doors for field-applied transparent finish with stain (if required) and other required pre-treatments and first coat of finish as specified in Division-9 section "Painting".

PART 3 - EXECUTION

- 3.01 **INSTALLATION:**
- A. **Install wood doors** to comply with manufacturer's instructions and of referenced AWI standard and as indicated.
 - B. **Install fire-rated doors** in corresponding fire-rated frames in accordance with requirements of NFPA No. 80.
- 3.02 **ALIGN AND FIT** doors in frames with uniform clearances and bevels. Machine doors for hardware. Seal cut surfaces after fitting and machining.
- 3.03 **PRE-FIT DOORS:** Fit to frames for uniform clearance at each edge.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

Quality Assurance:

Obtain access doors for entire project from one source from a single manufacturer.

Fire-Resistance Ratings: Provide UL listed access doors for rating shown.

Submittals: Manufacturer's standard details, specifications and installation instructions.

Warranty: Provide manufacturer's standard five (5) year warranty.

Products:

Manufacturers: One of the following:

Bar-Co., Inc.
Bilco
Cesco Products
J.L. Industries
Karp Associates, Inc.
Milcor, Inc.
Nystrom, Inc.
The Williams Brothers Corp.

Door and Frame: Access door shall be Model No. 3218-028 (24" x 36") as manufactured by Milcor Metal Access Door OR approved equal. Door leaf shall be 20 ga. door panel recessed to accept 5/8" GWB insert. Channel frame shall be 1/4" steel with an anchor flange around the perimeter. Material shall be primer painted steel. Hinge shall be continuous stainless steel pin type. Integrated concealed spring system shall be provided with self-latching hardware. All doors shall be equipped with key operated cylinder lock and interior latch release mechanism.

Locking Devices: Provide one cylinder lock per access door, with 2 keys per lock.

Location: **General Contractor to install where needed in walls and ceilings to access mechanical, plumbing, and electrical systems that require regular maintenance and/or resetting of dampers and/or access to ceiling mounted vendor equipment for required connections.**

Coordinate locations in GWB ceiling for access to existing utilities above the ceiling and access for AHJ to view smoketight and rated wall penetrations, if applicable.

Coordinate locations of access panels with electrical drawings.

Execution:

Installation: Coordinate installation with work of other trades and locate accurately. Comply with manufacturer's instructions for secure attachment, proper relation to adjacent finished surfaces and proper operation.

END OF SECTION 083113

SECTION 085113 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.01 **Standards:** Comply with applicable requirements for aluminum windows, terminology and standards of performance, and fabrication workmanship specified in ANSI/AAMA 101-88.

1.02 **SYSTEM DESCRIPTION**

- A. **Standard Window Design Requirements:** Comply with air infiltration, water penetration and structural performance requirements indicated in AAMA 101-88 for the type, grade and performance class of window units required.
1. The "Performance Class Number" included as a part of the window designation system is the actual design pressure in pounds per sq. ft. used to determine the structural test pressure and the water test pressure.
 2. Where the required design pressure exceeds the minimum for the specified window grade, comply with requirements of AAMA 101-88, Section 3, "Optional Performance Classes" for higher than minimum performance class.
 3. **Design wind velocity** at the project site is 200 mph.
 - a. The Building's velocity and pressures are to be based on 200 mph; see sheet S0.1 for the requirements on Components and Cladding. The missile testing for all exterior components of the **Building** shall be a **15-pound (6.8 kg) sawn lumber 2 by 4** traveling **90 mph Vertical Surfaces 60 mph Horizontal Surfaces** per the ICC 500. Window, glazing & frame assembly must be successfully missile impact & pressure tested **to meet ASTM E1886, ASTM 1996, TAS 201, TAS 202 and TAS 203.**
 4. All exterior window assemblies to meet ASCE 7-22.
- B. **Sizes and Profiles:** Required sizes for window units and profile requirements are indicated on the drawings. Variable dimensions are indicated along with maximum and minimum dimensions as required to achieve design requirements and coordination with other work.
- C. **Thermal-Break Construction:** Fabricate aluminum window units with integrally concealed low conductance thermal barrier, located between exterior materials and members exposed on the interior, in a manner that eliminates direct metal-to-metal contact.
1. **Provide weepholes** and internal water passages to conduct infiltrating water to the exterior.

1.03 **SUBMITTALS**

- A. **Submit product data,** including half-size details of each typical section, showing glazing details. Submit specific information on operating parts, hardware, weatherstripping, finishes for aluminum and pre-glazed construction.
- B. **Submit shop drawings** showing elevations, details and anchorages for work not detailed in product data.
- C. **Submit finish samples** of 8" long extrusions of typical sections.

1.04 **QUALITY ASSURANCE**

- A. **Installer Qualifications:** Engage an experienced installer who has completed installation of aluminum windows similar in design and extent to those required for the project and whose work has resulted in construction with a record of successful in-service performance.
- B. **Standards:** Requirements for aluminum windows, terminology and standards of performance, and fabrication workmanship are those specified and recommended in AAMA 101 and applicable general recommendations published by AAMA.

SECTION 085113 - ALUMINUM WINDOWS (continued):

- C. Single-Source Responsibility: Provide aluminum window units from one source and produced by a single manufacturer.
 - D. Pre-Installation Conference:
 - 1. Comply with Section 013200 – Project Meetings.
 - 2. Convene one week before starting work of this section.
- 1.04 **WARRANTIES**: The Contractor shall assume full responsibility and warrant for one year the satisfactory performance of the total window installation which includes that of the windows, hardware, glazing, anchorage and setting system, sealing, flashing, etc. as it relates to air, water, and structural adequacy as called for in the specifications and approved shop drawings. Provide window manufacturer's standard five (5) year written warranty agreeing to repair or replace window units that fail in materials or workmanship within the specified warranty period. Failures include but are not necessarily limited to:
- A. Structural failures including excessive deflection, excessive leakage, or air infiltration.
 - B. Faulty operation of sash and hardware.
 - C. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- Any deficiencies due to such elements not meeting the specifications shall be corrected by the Contractor at his expense during warranty period.

PART 2 - PRODUCTS

- 2.01 **MANUFACTURERS**: Provide *FEMA*, 3 ½" aluminum fixed window "Series 3350" by Winco Corp. or equal window by one of the following:
- A. Apogee Architectural Metals
 - B. Kawneer Company Inc.
 - C. Modu-Line Windows
- 2.02 **Types (Operation)**: The drawings indicate locations of fixed window units.
- 2.03 **Grade (NAFS Classification)**: Provide window units of grade and performance class; FW-AW200 for Fixed Units.
- 2.04 **MATERIALS**
- A. **Aluminum Extrusions**: Provide alloy and temper recommended by the window manufacturer for strength, corrosion-resistance, and application of required finish, but not less than 22,000 psi ultimate tensile strength and not less than 0.125" thickness at any location for main frame and sash members.
 - 1. Extruded aluminum billet, 6063-T5 or T6 alloy for primary non-radius components; 6063-T5 or T6, 6005-T5, 6105-T5 or 6061-T6 for anchor components; all meeting the requirements of ASTM B221.
 - 2. Aluminum sheet alloy 5005-H32 (for anodic finishing), or alloy 3003-H14 (for painted or unfinished sheet) meeting the requirements of ASTM B209.
 - 3. Principal window frame and sash ventilator members will be a minimum 0.125" in thickness at hardware mounting locations.
 - 4. Extruded or formed trim components will be a minimum 0.060" in thickness.
 - 5. Frame depth 3 ½" minimum.
 - 6. Sash ventilator sections must be tubular, and close flush with adjoining frame surfaces at interior and exterior.
 - i. Overlap sash ventilators will not be accepted.
 - B. **Fasteners**: Provide aluminum, non-magnetic stainless steel, epoxy adhesive, or other materials warranted by the manufacturer to be non-corrosive and compatible with aluminum window

SECTION 085113 - ALUMINUM WINDOWS (continued):

members, trim, hardware, anchors and other components of window units.

Where fasteners screw-anchor into aluminum less than 0.125" thick, reinforce the interior with aluminum or non-magnetic stainless steel to receive screw threads, or provide standard non-corrosive pressed-in splined grommet nuts.

Except where unavoidable for application of hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

2.05 COMPONENTS:

- A. Hardware: Provide manufacturer's standard hardware of type indicated, for required type and grade of window units.
 - 1. All steel components including attachment fasteners to be stainless steel except as noted.
 - 2. Extruded aluminum components 6063-T5 or -T6.
 - 3. Locking handles, bases and strikes to be die cast, white bronze or stainless steel in manufacturer's standard surface finish.
 - 4. Thermo-plastic or thermo-set plastic caps, housings and other components to be injection-molded nylon, extruded PVC, or other suitable compound.
 - 5. Hardware to be occupant-operated
- B. Sealants
 - 1. All sealants shall comply with applicable provisions of AAMA 800 and/or Federal Specifications FS-TT-001 and 002 Series.
 - 2. Frame joinery sealants shall be suitable for application specified and as tested and approved by window manufacturer.
- C. Glass
 - 1. Provide in accordance with Section 08 80 00.
 - 2. Sealed insulating glass shall be tested and certified in accordance with ASTM E2190.
- D. Glazing
 - 1. Provide in general accordance with Section 08 80 00.
 - 2. Glazing method shall be in general accordance with the GANA Glazing Manual for specified glass type, or as approved by the glass fabricator.
- E. Glazing Materials
 - 1. Setting Blocks/Edge Blocking: Provide in sizes and locations recommended by GANA Glazing Manual. Setting blocks used in conjunction with soft-coat low-e glass shall be silicone.
 - 2. Back-bedding tapes, expanded cellular glazing tapes, toe beads, heel beads and cap beads shall meet the requirements of applicable specifications cited in AAMA 800.
 - 3. Glazing gaskets shall be non-shrinking, weather-resistant, and compatible with all materials in contact.
 - 4. Structural silicone sealant where used shall meet the requirements of ASTM C1184.
 - 5. Spacer tape in continuous contact with structural silicone shall be tested for compatibility and approved by the sealant manufacturer for the intended application.
 - 6. Gaskets in continuous contact with structural silicone shall be extruded silicone or compatible material.
- F. Muntins:
 - 1. Provide muntin grids as shown on architectural drawings.
 - 2. Finish to match window frames.
- G. Panning:
 - 1. Panning shall be pre-assembled, and all joinery back sealed prior to installation.
 - 2. Finish to match window frames.

SECTION 085113 - ALUMINUM WINDOWS (continued):

- H. Receptors:
 - 1. Provide extruded aluminum receptors to receive windows, as shown on architectural drawings.
 - 2. Finish to match window frames.
- I. Insect Screens:
 - 1. Tubular extruded aluminum frames shall meet the requirements of ANSI/SMA 1004.
 - 2. Screen frame finish to match window frames.
 - 3. Aluminum cloth shall comply with GSA-FS-RR-W-365 and USDC-CS-138 with 18 x 16 mesh.
 - 4. Cloth mesh color shall be charcoal.
- J. Weatherstripping: Provide the manufacturer's standard weatherstripping at each edge of each operable sash.
- K. Limit restrictors shall be provided at all walkway locations and shall limit the edge of the window from projecting beyond the face of the window.

2.05 FABRICATION

- A. General:
 - 1. Finish, fabricate and shop assemble frame and sash ventilator members into complete windows under the responsibility of one manufacturer.
 - 2. No bolts, screws or fastenings shall impair independent frame movement, or bridge the thermal barrier, unless such bridging was also present in thermal test units and thermal models.
 - 3. Fabricate to allow for thermal movement of materials when subjected to a temperature differential from -30 °F to +180 °F.
 - 4. Include a complete system for assembly of components and anchorage of window units.
- B. Frames:
 - 1. Cope and mechanically fasten each corner, or miter and weld, or corner block each corner; then seal weather tight.
 - 2. Make provisions for continuity of frame joinery seals at extrusion webs.
- C. Main Sash Ventilator
 - 1. Miter all corners and mechanically stake over a solid extruded aluminum corner block, set and sealed in epoxy, leaving hairline joinery, then sealed weather tight.
 - 2. Make provisions for continuity of sash ventilator joinery seals at extrusion webs.
- D. Preglazed Fabrication:
 - 1. Preglaze window units at the factory where possible and practical for applications indicated. Comply with glass and glazing requirements of the "Glass and Glazing" sections of these specifications, and AAMA 101.
- E. Hardware:
 - 1. Concealed Hinges
 - a. Provide two stainless steel concealed four-bar adjustable friction hinges per vent meeting AAMA 904.1.
 - 2. Locks
 - a. Die cast, lacquered or e-coated white bronze, or stainless-steel cam locks, strikes and/or keepers for manual operation shall secure sash in closed position.
 - b. Provide locks for ventilators at maximum 40" spacing; 50" for single operator multi-lock hardware.
 - c. Provide double grip hardware activated by a lower device for locks exceeding 6'-0" from floor.

SECTION 085113 - ALUMINUM WINDOWS (continued):

- F. Thermal Break Construction:
 - 1. Continuous extruded polyamide with 25% glass fiber reinforcing, mechanically crimped into cross-knurled cavities.
 - 2. Minimum thermal barrier width 24 mm.
 - 3. Quality assurance records must be maintained and available as requested.
- G. Weather-stripping:
 - 1. Bulb- or fin-type neoprene, EPDM, dual-durometer PVC, polypropylene, TPE, or other suitable material as tested and approved by the window manufacturer.
 - 2. Miter, crowd, stake or join at corners. Provide drainage to exterior as necessary.
 - 3. Weather-stripping shall provide an effective seal at the interior face of the sash ventilator.

2.06 FINISHES

- A. General: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
- B. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.
- C. Aluminum Finish: AAMA 607 clear anodized aluminum finish conforming to AA-M10-C22-A41 Class I, 1.7 mils thick.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Inspect openings before beginning installation. Verify that rough or masonry opening is correct and the sill plate is level.

3.02 Installation:

- A. Anchor window units securely in place, with permanent separations to prevent electrolytic corrosion. Seal the entire perimeter of each unit as shown; comply with applicable requirements of the "Joint Sealant" section.
- B. Adjust and lubricate operating sash and hardware for proper operation.
- C. Clean aluminum surfaces promptly after installation; do not damage protective coating. Repair minor damage to the finish. Clean glass promptly after installation.

3.03 Process for Inspection of concrete window post installed anchors:

- A. Verify screw heads are installed per approved detail periodically including edge distance, and spacing distance prior to drywall installation.
- B. Observe the installation procedure at the beginning of installation. This is to verify proper construction technique and ability.

END OF SECTION 085113

SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:

- 1. Mechanical and electrified door hardware for:
 - a. Swinging doors.
- 2. Field verification, preparation and modification of existing doors and frames to receive new door hardware.
- 3. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

- 1. Windows
- 2. Cabinets (casework), including locks in cabinets
- 3. Signage
- 4. Toilet accessories
- 5. Overhead doors

C. Related Sections:

- 1. Division 01 Section "Alternates" for alternates affecting this section.
- 2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
- 3. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.

1.03 REFERENCES

- A. UL - Underwriters Laboratories
 - 1. UL 10B - Fire Test of Door Assemblies
 - 2. UL 10C - Positive Pressure Test of Fire Door Assemblies
 - 3. UL 1784 - Air Leakage Tests of Door Assemblies
 - 4. UL 305 - Panic Hardware
- B. DHI - Door and Hardware Institute
 - 1. Sequence and Format for the Hardware Schedule
 - 2. Recommended Locations for Builders Hardware
 - 3. Key Systems and Nomenclature

SECTION 08 71 00 – DOOR HARDWARE (continued)

- C. ANSI - American National Standards Institute
 - 1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
- D. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- E. ICC 500 - International Building Code, ALL Sections, and especially Sections 507, 702 & Chapter 8
- F. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- G. ITS (DIR) - Directory of Listed Products current edition.
- H. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
- I. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2022.
- K. FEMA P-361 – Safe Rooms for Tornadoes and Hurricanes

1.04 SUBMITTALS

A. General:

- 1. Submit in accordance with Conditions of Contract and Division 01 requirements.
- 2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
- 3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article.

B. Action Submittals:

- 1. Product Data: Technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
- 2. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
- 3. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
 - a. Door Index; include door number, heading number, and Architects hardware set number.
 - b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
 - c. Quantity, type, style, function, size, and finish of each hardware item.
 - d. Name and manufacturer of each item.
 - e. Fastenings and other pertinent information.
 - f. Location of each hardware set cross-referenced to indications on Drawings.
 - g. Explanation of all abbreviations, symbols, and codes contained in schedule.
 - h. Mounting locations for hardware.

SECTION 08 71 00 – DOOR HARDWARE (continued)

- i. Door and frame sizes and materials.
 - j. Name and phone number for local manufacturer's representative for each product.
 - k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components).
Operational description should include operational descriptions for: egress, ingress (access), and fire/smoke alarm connections.
 - 1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.
4. Key Schedule:
- a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
 - b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
 - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
 - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
 - e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
 - 1. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
 - f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.
5. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory or shop prepared for door hardware installation.

C. Informational Submittals:

- 1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
- 2. Product data for electrified door hardware:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
- 3. Certificates of Compliance:
 - a. UL listings for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
 - b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in "QUALITY ASSURANCE" article.
 - c. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in "QUALITY ASSURANCE" article.

SECTION 08 71 00 – DOOR HARDWARE (continued)

4. Florida Building Code: provide a copy of current State of Florida Product Approval as proof of compliance that doors, frames and hardware for exterior opening assemblies have been tested and approved for use at the wind load and design pressure level requirements specified for the Project. See S0.1 for pressure requirements on Components & Cladding.
 - a. The new building's velocity and pressures are based on 200 mph. The Building's missile testing for all exterior components shall pass a **15-pound (6.8 kg) sawn lumber 2 by 4** traveling **90 mph Vertical Surfaces 60 mph Horizontal Surfaces as per ICC 500**.
5. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
6. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Factory order acknowledgement numbers (for warranty and service)
 - d. Name, address, and phone number of local representative for each manufacturer.
 - e. Parts list for each product.
 - f. Final approved hardware schedule, edited to reflect conditions as-installed.
 - g. Final keying schedule
 - h. Copies of floor plans with keying nomenclature
 - i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.05 QUALITY ASSURANCE

- A. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
 1. Warehousing Facilities: In Project's vicinity.
 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
 4. Coordination Responsibility: Assist in coordinating installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
 - a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

SECTION 08 71 00 – DOOR HARDWARE (continued)

- B. Architectural Hardware Consultant Qualifications: 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 meets these requirements:
1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
 2. Can provide installation and technical data to Architect and other related subcontractors.
 3. Can inspect and verify components are in working order upon completion of installation.
 4. Capable of producing wiring diagrams.
 5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.
- C. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing both standard and electrified builders' hardware 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.
- D. Single Source Responsibility: Obtain each type and variety of Door Hardware specified in this Section from a single source, qualified supplier unless otherwise indicated.
1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third-party source will not be accepted.
 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- E. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- F. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article.
- G. Tornado and Windload tested Hardware: Provide hardware that meets the tornado and windload test requirements in accordance with the Florida Building code, ICC500 Section 507 and are in compliance with the local authority having jurisdiction. All openings on the Exterior of the building are required to meet the Impact and Windload pressure tests as indicated on the Structural drawings and shall be tested as systems with the finish hardware, hollow metal doors, and frames.
1. Door Hardware Latching Mechanism shall automatically engage.
 2. If the Latching is occupant engaged, then a Sign shall be provided with instructions for latching during storm shelter use.
 3. Once Shelter Latching is engaged, the non-egress side shall be locked, disabled or inactive and shall not be susceptible to unintentional unlatching by debris impact.
- H. Keying Conference
1. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - b. Preliminary key system schematic diagram.

SECTION 08 71 00 – DOOR HARDWARE (continued)

- c. Requirements for key control system.
- d. Address for delivery of keys.

I. Pre-installation Conference

- 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- 2. Inspect and discuss preparatory work performed by other trades.
- 3. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
- 4. Review sequence of operation narratives for each unique access controlled opening.
- 5. Review required testing, inspecting, and certifying procedures.

J. Coordination Conferences:

- 1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

- 1. Deliver each article of hardware in manufacturer's original packaging.

C. Project Conditions:

- 1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- 2. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:

- 1. Promptly replace products damaged during shipping.
- 2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
- 3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

F. Deliver keys and cores to Owner by registered mail or overnight package service.

SECTION 08 71 00 – DOOR HARDWARE (continued)

1.07 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- E. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.08 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Beginning from date of Substantial Completion, for durations indicated.
 - a. Closers:
 - 1. Mechanical: 30 years.
 - b. Exit Devices:
 - 1. Mechanical: 3 years.
 - c. Locksets:
 - 1. Mechanical: 10 years.
 - d. Key Blanks: Lifetime
 - 2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.09 MAINTENANCE

- A. Maintenance Tools: Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

SECTION 08 71 00 – DOOR HARDWARE (continued)

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Approval of manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturers” in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article.
- B. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fasteners

- 1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
 - 2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 - 3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
 - 4. Install hardware with fasteners provided by hardware manufacturer.
- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
- 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.03 HINGES

A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product: Ives 5BB series.
- 2. Acceptable Manufacturers and Products: Hager BB series, Stanley FBB Series.

B. Requirements:

- 1. Provide hinges conforming to ANSI/BHMA A156.1.
- 2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

SECTION 08 71 00 – DOOR HARDWARE (continued)

3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
4. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
5. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
6. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Interior Non-lockable Doors: Non-rising pins
7. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.

2.04 SURFACE BOLTS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:

1. Surface bolts to have 1" throw for maximum security with concealed mounting that prevents vandalism. Units to be constructed of heavy duty steel and cUL listed up to three (3) hours when used on the inactive door of a pair up to 8' in height.

2.05 MORTISE LOCKS (MULTI-POINT)

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage LM9000 series or approved equal

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.37, Grade 1, and UL Listed for 3 hour fire doors.
2. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
3. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article.
4. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
 - a. Lever Design: Schlage 06
 - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

SECTION 08 71 00 – DOOR HARDWARE (continued)

2.06 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage ND series or approved equal

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3 hour fire doors.
2. Cylinders: Refer to "KEYING" article.
3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
 - a. Lever Design: Schlage Rhodes
 - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.07 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Von Duprin 98 series or approved equal

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to "KEYING" article.
3. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide flush end caps for exit devices.
7. Provide exit devices with manufacturer's approved strikes.
8. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
9. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
10. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
11. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.

SECTION 08 71 00 – DOOR HARDWARE (continued)

12. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
13. Top latch mounting: double or single tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
14. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.
 - a. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.08 CYLINDERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage Everest 29 S or approved equal

B. Requirements:

1. Provide cylinders/cores, from the same manufacturer of locksets, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article.
2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
 - a. Conventional Patented Open: cylinder with interchangeable core in an open keyway.
3. Patent Protection: Cylinders/cores requiring use of restricted, patented keys, patent-protected.
4. Nickel silver bottom pins.
5. Replaceable Construction Cores.
 - a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 1. 3 construction control keys
 2. 12 construction change (day) keys.
 - b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2.09 KEYING

- A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- B. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- C. Requirements:
 1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
 - a. Master Keying system as directed by the Owner.

SECTION 08 71 00 – DOOR HARDWARE (continued)

2. Forward biting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
3. Provide keys with the following features:
 - a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
 - b. Patent Protection: Keys and blanks protected by one or more utility patent.
4. Identification:
 - a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Do not provide blind code marks with actual key cuts.
 - b. Identification stamping provisions must be approved by the Architect and Owner.
 - c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE".
 - d. Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
 - e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
5. Quantity: Furnish in the following quantities.
 - a. Change (Day) Keys: 3 per cylinder/core.
 - b. Permanent Control Keys: 3.
 - c. Master Keys: 6.

2.10 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer: Telkee.
2. Acceptable Manufacturers: HPC, Lund.

B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
 - a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
 - b. Provide hinged-panel type cabinet for wall mounting.

2.11 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 1460 series or approved equal

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory.

SECTION 08 71 00 – DOOR HARDWARE (continued)

2. Provide door closers with fully hydraulic, full rack and pinion action cast iron cylinder.
3. Closer Body: 1-1/4 inch (32 mm) diameter, with 5/8 inch (16 mm) diameter heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.12 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
 - a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.13 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.14 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International.

SECTION 08 71 00 – DOOR HARDWARE (continued)

2. Acceptable Manufacturers: National Guard, Reese.

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Size of thresholds:
 - a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
 - b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
4. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.15 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.16 FINISHES

- ### A. Finish: Refer to Hardware Sets.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

SECTION 08 71 00 – DOOR HARDWARE (continued)

3.02 INSTALLATION

- A. 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. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- H. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).
- I. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as indicated in keying section.
 - 2. Furnish permanent cores to Owner for installation.
- J. Wiring: Coordinate with Division 26, ELECTRICAL sections for:
 - 1. Conduit, junction boxes and wire pulls.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to fire/smoke alarm system and smoke evacuation system.
 - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
 - 5. Testing and labeling wires with Architect's opening number.
- K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

SECTION 08 71 00 – DOOR HARDWARE (continued)

- L. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- M. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- N. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
- O. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- P. 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 may impede traffic or present tripping hazard.
- Q. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- R. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

3.03 FIELD QUALITY CONTROL

- A. Engage qualified manufacturer trained representative to perform inspections and to prepare inspection reports.
 - 1. Representative will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.04 ADJUSTING

- A. Initial Adjustment: 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.
 - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, Installer's Architectural Hardware Consultant must examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.05 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.

SECTION 08 71 00 – DOOR HARDWARE (continued)

- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.06 DOOR HARDWARE SCHEDULE

- A. Hardware items are referenced in the following hardware. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.

- B. Hardware Sets:

HARDWARE GROUP NO. 01

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	PANIC HARDWARE	WS-9927-L-06	626	VON
2	EA	ROD AND LATCH GUARD	WS-LGO-3-	630	VON
2	EA	RIM CYLINDER	20-057 ICX	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	1461 SCUSH STD TBSRT	689	LCN
2	EA	RAIN DRIP	11A	A	ZER
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	566A	A	ZER
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE

SECTION 08 71 00 – DOOR HARDWARE (continued)

HARDWARE GROUP NO. 02

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-WS-9927-L-06 24 VDC	626	VON
1	EA	ROD AND LATCH GUARD	WS-LGO-3-	630	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	1461 SCUSH STD TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	11A	A	ZER
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	566A	A	ZER
1	EA	MULTITECH READER	MT15 BY SECURITY PROVIDER	BLK	SCE
1	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC	LGR	SCE

DOORS NORMALLY CLOSED AND LOCKED. PRESENTATION OF VALID CREDENTIAL UNLOCKS DOORS. FREE EGRESS AT ALL TIMES. UPON LOSS OF POWER DOORS ARE CLOSED AND LOCKED.

HARDWARE GROUP NO. 03

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	WS-9927-L-06	626	VON
1	EA	ROD AND LATCH GUARD	WS-LGO-3-	630	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	1461 SCUSH STD TBSRT	689	LCN
1	EA	RAIN DRIP	11A	A	ZER
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	566A	A	ZER
1	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE

SECTION 08 71 00 – DOOR HARDWARE (continued)

HARDWARE GROUP NO. 04

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	MULT PT STOREROOM	LM9380T 06A	630	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	1461 SCUSH STD TBSRT	689	LCN
1	EA	RAIN DRIP	11A	A	ZER
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	566A	A	ZER
1	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE

HARDWARE GROUP NO. 05

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	SURFACE CLOSER	1461 SCUSH STD TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 06

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70P6D RHO	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 07

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S RHO	626	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ STD TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

SECTION 08 71 00 – DOOR HARDWARE (continued)

HARDWARE GROUP NO. 08

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	FLOOR STOP	FS436	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

END OF SECTION

SECTION 088000 - GLASS AND GLAZING

PART 1 - GENERAL

- 1.01 Glazing Standard: Comply with FGMA "Glazing Manual" and "Sealant Manual".
- 1.02 Safety Glazing Standard: Comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for category II materials.
- 1.03 Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F (250 deg C), and the fire-resistance rating in minutes.
- 1.04 Submittals: In addition to product data submit samples of each glass indicated (except for clear single pane units) and tint color.

PART 2 - PRODUCTS

- 2.01 Glass Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- | | |
|----------------------------|---------------------|
| Falconer Glass Industries. | Pilkington Sales |
| Oldcastle Glass, Inc. | PPG Industries Inc. |
| Guardian Industries Corp. | |
- 2.02 Sizes: Fabricate glass of thicknesses indicated and to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer.
- 2.03 Primary Glass Products: Comply with ASTM C 1036 for the following:
- A. Clear Float Glass: Type I, Class 1, Quality q3.
- B. Energy Efficient Low E, Tinted Float Glass: Type I, Class 2, Quality q3. of manufacturer's standard tint with U-value of .40, shading coefficient of .50 and Visible Transmittance value of .60.
- C. Mirror Units: 1/4" thick, tempered mirrors at locations and sizes indicated on the drawings.
- 2.04 Fire-Rated Glazing: Provide "Superlite II" by SAFTI complying with the following requirements: 60 min. rating per E-152, WHI 495-0608, UL R 10665-3, 450° temperture rise rating OR approved equal.
- 2.05 Uncoated Heat-Treated Glass Products: Comply with ASTM C 1048 and with manufacturing process indicated for the following:
- A. Clear Tempered Float Glass: Kind FT, Condition A, Type I, Class 1, Quality q3.
- B. Tinted Tempered Float Glass: Kind FT, Condition A, type I, Class 1, Quality q3 of manufacturer's standard tint with U-value of .40, shading coefficient of .50 and Visible Transmittance value of .60.
- 2.06 Sealed Insulating Glass Units, (Exterior Windows): Comply with requirements of ASTM E 774 for Class A units and the following:
- A. Performance characteristics indicated are those of units and are based on manufacturer's published test data for units with 1/4" thick panes and 1/2" thick air space. U-values are indicated in Btu per hr. per sq. ft. per deg. F difference.

SECTION 08800 - GLASS AND GLAZING (continued):

- B. For properties of individual glass panes making up units, refer to product requirements specified elsewhere in this section applicable to types, classes, kinds and conditions of glass products indicated.
 - C. Provide heat-treated panes of kind indicated and as recommended by glass manufacturer for application indicated.

Thickness of Each Pane: 1/4".
Air Space Thickness: 1/2".
Sealing System: Manufacturer's standard.
Spacer Material: Manufacturer's standard metal.
- 2.07 Laminated Glass Units, (Exterior Security Windows): Comply with requirements of ASTM C 1172 for Class A units and the following:
- A. Security characteristics are based on manufacturer's published test data for units with (3) 1/4" thick panes and .190 Interlayer.
 - B. Provide heat-treated panes of kind indicated and as recommended by glass manufacturer for application indicated.

Thickness of Each Pane: 1/4".
Interlayer: Manufacturer's Missile/Storm defense Interlayer.
Sealing System: Manufacturer's standard.
Spacer Material: Manufacturer's standard metal.
- 2.08 Glazing Sealant: Comply with sealant and glass manufacturers for selection of glass sealants which suit project application and installation conditions and which are compatible with surfaces contacted. Provide color of exposed sealants indicated or as selected by Architect.
- 2.09 Dense Elastomeric Compression Seal Gaskets: ASTM C 864, extruded or molded neoprene, EPDM, or thermoplastic polyolefin rubber.
- 2.10 Cellular Elastomeric Preformed Gaskets: ASTM C 509, Type II, black; extruded or molded neoprene.
- 2.11 Cleaners, Primers and Sealers: Type recommended by manufacturer of sealants/gaskets.
- 2.12 Blocks and Spacers: Neoprene, EPDM or silicone as required for compatibility with glazing sealants; of 80 to 90 Shore A hardness for setting blocks and, for spacers and edge blocks, of hardness recommended by glass and sealant manufacturer for application indicated.
- 2.13 Compressible Filler Rods: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, 5-10 psi compression strength for 25 percent compression.
- 2.14 All exterior aperture assemblies in the exterior envelopes of these buildings shall be successfully tested as follows:
- (1) Wind loads - wind speed $V_{ult} = 200$ mph minimum. See S0.1 for Components and Cladding pressures. Must pass Missile impact criteria per ICC 500: **15-pound (6.8 kg) sawn lumber 2 by 4** traveling **90 mph Vertical Surfaces 60 mph Horizontal Surfaces**. Window, glazing & frame assembly must be successfully missile impact & pressure tested **to meet ASTM E1886, ASTM 1996, TAS 201, TAS 202 and TAS 203.**
 - (2) All exterior assemblies to meet ASCE 7-22.

SECTION 08800 - GLASS AND GLAZING (continued):

PART 3 - EXECUTION

- 3.01 Glass Installation (Glazing): Comply with referenced FGMA standards and instructions of manufacturers of glass, glazing sealants, and gaskets, to achieve airtight and watertight performance, and to minimize breakage.
- 3.02 Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.
- 3.03 Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
- 3.04 Protect glass from contact with contaminating substances resulting from construction operations; remove any such substances by method approved by glass manufacturer.
- 3.05 Wash glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion. Wash glass by method recommended by glass manufacturer.

END OF SECTION 088000

SECTION 092900 - GYPSUM DRYWALL

PART 1 - GENERAL

- 1.01 **Fire-Resistance Ratings:** Provide gypsum drywall construction fire-resistance ratings indicated, conforming to assemblies tested per ASTM E 119 by inspecting and testing organization acceptable to authorities having jurisdiction.
- A. **All fire and/or smoke barriers or walls shall be effectively and permanently identified with stenciling above any decorative ceiling and/or in concealed space with letters a minimum of two (2) inches high on a contrasting background spaced a maximum of twelve (12) feet on center with a minimum of one per wall or barrier. The hourly fire rating shall be included on all rated barriers or walls. Wording shall be as follows: “() Hour Fire and Smoke Barrier-Protect All Openings.”**
- B. **Storage rooms which are sprinklered shall have permanently stenciled, eighteen (18) inches below sprinkler heads, a designation line (red) with the following wording: “NO STORAGE ABOVE LINE.” Requirements for stenciling shall be as noted above.**
- 1.02 **Submittals:** Provide documentation that all products are made in the U.S.A.

PART 2 - PRODUCTS

- 2.01 **Manufacturers:** Subject to compliance with requirements, provide gypsum board and related products by one of the following:
Georgia-Pacific Gypsum LLC
Lafarge North America Inc.
National Gypsum Company
USG Corporation.
- 2.02 **Steel Framing Components for Suspended Ceilings:** As follows, sized per ASTM C 754, unless otherwise indicated:
- A. **Wire for Hangers and Ties:** ASTM A 641, soft, Class 1 zinc coating.
- B. **Grid Suspension System:** ASTM C 645, manufacturer's standard grid suspension system composed of main beams and cross furring members which interlock to form a modular supporting network.
- 2.03 **Steel Framing for Walls and Partitions:** Comply with ASTM C 754 and the following:
- A. **Steel Studs and Runners:** ASTM C 645, 0.0179 inch (25 gauge) base metal thickness unless otherwise indicated.
1. Height for which 0.0179 inch (25 gauge) is insufficient per manufacturer's "Limiting Height Tables", shall be accomplished in the gauge of material required by these tables.
Such materials to be provided at no additional cost to the Owner.
2. All door frame openings shall be reinforced with two (2) 0.0312 inch (20 gauge) studs on each side for a total of four (4) studs.
- B. **Base Track:** ASTM C 645, 0.0312 inch (20 gauge) for interior; 0.0538 inch (16 gauge) for exterior.
- C. **Top Track:** Slip Track, 0.0312 inch (20 gauge) for interior; 0.0538 inch (16 gauge) for exterior.
- D. **Steel Rigid Furring Channels:** ASTM C 645, 0.0179 inch (25 gauge) base metal thickness, hat-shaped.

SECTION 092900 - GYPSUM DRYWALL (continued):

- 2.04 **Gypsum Board:** Provide gypsum board of types indicated in maximum lengths available to minimize end joints:
- A. **Exposed Gypsum Board:** ASTM C 36, 5/8" thickness, type 'X'. For fire rated assemblies refer to drawings for UL design numbers.
 - B. **Moisture & Mold Resistant Gypsum Board:** ASTM C 1396, 5/8" thickness, regular type except where Type X Fire-resistant type is indicated or required to meet UL assembly types. Edges shall be tapered. Provide Sheetrock brand Mold Tough Firecode Gypsum Panels by USG OR approved equal. **Note: All wet areas to receive Moisture & Mold Resistant Gypsum Board. Wet areas include walls and ceilings where gypsum board is specified. Areas include, but are not necessarily limited to, bathrooms, gang toilets, showers, janitor closets, kitchens and laundry areas.**
 - C. **Gypsum Wallboard Sheathing:** ASTM C79, 5/8" thickness, regular edges. Treated gypsum core shall be encased with specially treated water repellent paper on both sides and long edges. Application requires a 15# asphalt impregnated felt paper in cavity between gypsum sheathing and brick veneer.
 - D. **Mineral Board:** Provide 1/2" gypsum sheathing board core in accordance with ASTM C 1177 with glass mats both sides and long edges. Application requires a No.15, nonperforated, asphalt saturated felt complying with ASTM D 226, Type 1 or equal. Provide Dens-Glass Gold by Georgia-Pacific Corp. OR approved equal.
 - E. **Abuse Resistant Gypsum Board:** ASTM E-136, ASTM E-84, ASTM E-119, 5/8" thickness, Fiberock Brand Panels - VHI Abuse-Resistant OR approved equal. Apply to 20 ga. (min) steel studs. **Provide to a height of 8'-0" in all locations.**
- 2.05 **Trim Accessories:** ASTM C 840; manufacturer's standard trim accessories, including cornerbead and edge trim of beaded type with face flanges for concealment in joint compound.
- 2.06 **Gypsum Board Joint Treatment Materials:** ASTM C 475 and ASTM C 840, and as follows:
- A. **Joint Tape:** Paper reinforcing tape, unless open-weave glass fiber tape is recommended by gypsum board manufacturer.
 - B. **Setting-Type Joint Compound:** Factory-prepackaged, job-mixed chemical-hardening powder products formulated for uses indicated.
 - C. **Drying-Type Joint Compounds:** Factory-prepackaged -premixed vinyl-based products. Taping compound formulated for embedding tape and first coat over fasteners and flanges of corner beads and edge trim. Topping compound formulated for fill (2nd) and finish (3rd) coats.
- 2.07 **Miscellaneous Materials:** As recommended by gypsum board manufacturer:
- A. **Gypsum Board Screws:** ASTM C 1002.
 - B. **Concealed Acoustical Sealant:** Comply with requirements specified in Division-7 Section "Joint Sealers."

PART 3 - EXECUTION:

- 3.01 **Install steel framing** to comply with ASTM C 754 and ASTM C 840.
- A. **Do not bridge** building expansion joints with support systems, frame both sides of joints with furring and other supports as indicated.
 - B. **Secure hangers** to structural support by connecting directly to structure where possible, otherwise connect to inserts, clips other anchorage devices or fasteners as indicated.

SECTION 092900 - GYPSUM DRYWALL (continued):

- C. Install direct-hung grid suspension system, including perimeter wall track or angle, with members spaced and installed to comply with mfr's instructions.
 - D. Install steel studs with bottom and top runner tracks anchored to substrates. Isolate system from building structure to prevent transfer of loading and deflections into metal support system, both vertically and horizontally.
 - E. Install supplementary framing, runners, furring, blocking and bracing at openings and terminations in gypsum drywall and where required for support of other work which cannot be adequately supported on gypsum board alone.
- 3.02 Install and finish gypsum board to comply with ASTM C 840 and as follows:
- A. Isolate drywall construction from abutting structural and masonry work; provide edge trim and acoustical sealant as recommended by manufacturer.
 - B. Screw gypsum board to metal supports.
 - C. Do not bridge building expansion joints. Leave space of the width indicated between boards, and trim both edges for installation of sealant or gasket.
- 3.03 Install water-resistant backing board where indicated to receive thin-set tile.
- 3.04 Drywall Finishing: Apply joint tape and joint compound at joints between gypsum boards. Apply compounds indicated below at accessory flanges, penetrations, fastener heads and surface defects.
- A. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
 - 1. Level 4:
 - a. All Joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Note: It is recommended that the prepared surface be coated with a drywall primer prior to the application of final finishes. (See Section 099000 – Painting.)
- 3.05 Install compound in 3 coats (plus prefill of cracks where recommended by manufacturer); sand between coats and after last coat.
- A. Embedding and First Coat: Ready-mix drying type all-purpose of taping compound.
 - B. Fill (Second) Coat: Ready-mix drying type all-purpose or topping compound.
 - C. Finish (Third) Coat: Ready-mix drying-type all-purpose or topping compound.

END OF SECTION 092900

SECTION 095100 - ACOUSTICAL CEILINGS

PART 1 - GENERAL

- 1.01 Acoustical Panel and Tile Standard: FS SS-S-118.
- 1.02 Acoustical Suspension System Standards: ASTM C 635 for materials, ASTM C 636 for installation.
- 1.03 Surface Burning Characteristics: 5 or less for flame spread, 50 or less for smoke developed, per ASTM E84
- 1.04 Submittals: Submit product data for each type of acoustical ceiling tile along with 6" square samples of each type of acoustical tile.
- 1.05 Coordination: Review Finish Plan on drawings and Mechanical and Electrical Drawings for layout and pattern of acoustical units, location of recessed light fixtures, ceiling diffusers and grilles, details of ceiling penetrations, details of fire rated acoustical treatment, access doors and necessary connections to work of other trades.
Provide coordination drawings for reflected ceiling plans drawn accurately to scale and coordinating penetrations and ceiling-mounted items. Show the following:
1. Ceiling suspension members.
 2. Methods of attaching hangers to building structure.
 3. Size and location of initial access modules.
 4. Ceiling-mounted items including light fixtures; air outlets and inlets; speakers; sprinkler heads; and column penetrations and other junctures with adjoining construction.
- 1.06 Installer Qualifications: Engage an experienced Installer who has successfully completed acoustical ceilings similar in material, design and extent to that indicated for Project.
- 1.07 Pre-installation Conference: Conduct a pre-installation conference at the Project site to coordinate work from all trades.
- 1.08 Delivery, Storage and Handling: Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination and other causes. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
- 1.09 Deliver extra materials to Owner. Furnish extra materials of each size and type matching products installed and equaling 2.0% of acoustical units and exposed suspension members installed. Package materials in protective covering and identify with appropriate labels.
- 1.10 Warranty: Provide acoustical panels and grid from the same manufacturer with a thirty-year warranty from the date of substantial completion.

PART 2 - PRODUCTS:

- 2.01 **ACT 1**– Wet formed mineral fiber with factory applied latex paint; Type III; Form 2; Class A and as follows:
Color: White.
Light Reflectance: 82%
NRC: 0.70
CAC: 35.
Edge Detail: Square
Size: 24" x 24" x 3/4".
Products: Subject to compliance with requirements, provide "School Zone Fine Fissured with High Acoustics" #1713, by Armstrong OR approved equal.

SECTION 095100 - ACOUSTICAL CEILINGS (continued):

Sag Resistance: HumiGuard+

Antimicrobial: BioBlock+

Recycled Content: Up to 56%

VOC Emissions: Greenguard Gold Certified

- 2.02 Dimensional Stability: Suspension systems shall meet or exceed the requirements of ASTM C635 for dimensional tolerances, coatings and finishes, and load carrying capabilities.
- 2.03 Humidity control: Ceilings shall have a 30-year system warranty against system sagging and warping when installed according to manufacturer's recommendations. Ceilings shall have an anti-microbial warranty against fungi, mold, mildew, bacteria, yeast or algae.
- 2.04 Suspension Systems:
- A. Non-Fire-Resistance-Rated Exposed Double Web Steel Direct-Hung Suspension System with 15/16" Wide Exposed Faces: Roll-formed from prefinished cold-rolled steel sheet, with hanger wire, attachment devices and edge moldings and trim; intermediate-duty system structural classification; white painted finish. Note: All cold-rolled steel sheets shall be hot dipped galvanized (G-30). Armstrong – 15/16" Prelude XL. (Use at all ACT locations.)
(Armstrong Ceiling Tile shall be installed with Armstrong's Suspension System in order to keep the 30 year warranty - No exceptions).

PART 3 - EXECUTION

- 3.01 Project Conditions: Do not install interior acoustical ceilings until space is enclosed and weatherproof, wet work in space is completed and nominally dry, work above ceilings is complete, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.
- 3.02 Layout: Balance ceiling borders on opposite sides, using more-than-half-width acoustical units.
- 3.03 Tolerance: 1/8" in 12'-0" level tolerance.
- 3.04 Suspension System: Secure to building structure, with hangers spaced 4'-0" along supported members.
- 3.05 Edge Moldings: Secure to substrate with screw anchors spaced 16" o.c. Miter corner joints. Cope exposed edges of intersecting exposed suspension members to produce flush intersections.
- 3.06 Damaged ceiling panels: Prior to Substantial Completion, remove and replace skinned, damaged or dirty ceiling panels with new material.
- 3.07 Cleaning: Clean exposed surfaces of acoustical ceilings, including trim, edge moldings and suspension members. Comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095100

SECTION 096500 - RESILIENT WALL BASE

PART 1 - GENERAL

1.01 SUMMARY

Section Includes: RESILIENT WALL BASE

1.02 REFERENCED DOCUMENTS

- A. ASTM International
 1. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
 2. E648, Standard Test Method for Critical Radiant Flux of Flooring Systems Using a Radiant Energy Source.
 3. E662, Test Method for Specific Density of Smoke Generated by Solid Materials.
 4. F137, Standard Test Method for Flexibility of Resilient Flooring Materials with Cylindrical Mandrel Apparatus.
 5. F925, Standard Test Method for Resistance to Chemicals of Resilient Flooring.
 6. F1861, Standard Specification for Resilient Wall Base.
- B. Other Referenced Documents
 1. National Fire Protection Association (NFPA), NFPA 255; Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source.
 2. National Fire Protection Association (NFPA), NFPA 258; Test Method for Specific Density of Smoke Generated by Solid Materials.
 3. The Collaborative for High Performance Schools (CHPS).

1.03 SUBMITTALS

- A. Product Data: Submit product data, including manufacturer's specification summary sheet for specified products.
- B. Shop Drawings: Submit shop drawings showing layout, finish colors, patterns and textures.
- C. Samples: Submit selection and verification samples for finishes, colors, and textures.
- D. Quality Assurance Submittals: Submit the following
 1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
 2. Manufacturer's Instructions: Manufacturer's installation and maintenance instructions.
- E. Maintenance Information: Maintenance information for installed products in accordance with Division 1 sections.
 1. Methods for maintaining installed products.
 2. Precautions against cleaning materials and methods detrimental to finishes and performance.
- F. Warranty: Warranty documents specified herein.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installing work similar to that required for this project.
- B. Regulatory Requirements
 1. Fire Performance characteristics: Provide resilient wall base with the following Fire performance characteristics as determined by testing products in accordance with ASTM method (and NFPA method) indicated below by a certified testing laboratory or another testing and inspecting agency acceptable to authorities having jurisdiction.

SECTION 096500 - RESILIENT WALL BASE (Continued):

- a. ASTM E648 (NFPA 253), Critical Radiant Flux of Floor Covering Systems; Class 1, Greater than 0.45 W/cm².
 - b. ASTM E662 (NFPA 258), Specific Optical Density of Smoke Generated by Solid Materials; < 450.
- C. Single-Source Responsibility: Obtain resilient wall base tile and manufacturer's recommended adhesive from a single supplier.
- D. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, Manufacturer's conditions, recommended adhesive depending on product, substrate type and type of installation, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with requirements in Division 1.

1.05 DELIVERY, STORAGE AND HANDLING

- A. General: Comply with requirements in Division 1.
- B. Ordering: Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with Identification labels intact.
- D. Storage and Protection: Store materials protected from exposure to harmful weather conditions and acclimated to site conditions at temperature and humidity conditions recommended by manufacturer.

1.06 PROJECT CONDITIONS

- A. Environmental Requirements/Conditions: In accordance with manufacturer's recommendations, areas to receive rubber flooring shall be clean, fully enclosed, weather tight with the permanent HVAC set at a uniform temperature of 65° - 85° F for 48 hours prior to, during and thereafter installation of rubber flooring. Rubber flooring and adhesive shall be conditioned in the same manner. Rubber flooring/tile must be un-boxed at least 48 hours prior to installation in the areas in which it will be installed.

1.07 SEQUENCING AND SCHEDULING

- A. Finishing Operations: Install resilient wall base after finishing operations, including floor covering, painting and ceiling operations, have been completed.

1.08 MAINTENANCE

- A. Extra Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1, Closeout Submittals Section.
- B. Quantity: Furnish quantity of resilient wall base equal to 5% of amount to be installed.
- C. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra materials.
- D. Maintenance of finished resilient wall base to be conducted per Manufacturer's Maintenance Guide.

1.09 WARRANTY

- A. Manufacturer's Materials Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document. Manufacturer's warranty is in addition to, and not a limitation of, other rights

SECTION 096500 - RESILIENT WALL BASE (Continued):

Owner may have under Contract Documents.

1. Warranty: 1 year limited warranty commencing on Date of Substantial Completion.
Notice of any defect must be made in writing to manufacturer within 30 days after buyer learns of the defect.

PART 2 - PRODUCTS

2.01 RESILIENT WALL BASE

- A. Manufacturer: Tarkett OR Approved Equal.
- B. Test results
 1. ASTM D570, Water Absorption of Plastics; < 0.15%.
 2. ASTM E84 (NFPA 255), Surface Building Characteristics of Building Materials; Class C.
 3. ASTM E648 (NFPA 253), Critical Radiant Flux; Class 1, > 1.0 W/cm².
 4. ASTM E662 (NFPA 258), Specific Optical Density of Smoke Generated by Solid Materials; Passes.
 5. ASTM F925, Resistance to Chemicals; Passes, List Available.
 6. ASTM F1515, Light Stability; Excellent.
 7. ASTM F1861, Standard Specification for Resilient Wall Base - Types TS, TP & TV, Group 1 & 2, Styles A&B; (Federal Specification SSW40a, Type II, Styles A&B).
- C. Product:
 1. Traditional wall base OR Approved Equal.
 - a. Complies with ASTM F 1861 Type TP (Thermoplastic Rubber), Group 2 (Layered).
 - b. Profile:
 - 1) Standard Toe (Cove base)
 - c. Height:
 - 1) 4" (101.6 mm)
 - d. Length:
 - 1) 120' (36.57 m) Coils - **48" pieces are not acceptable.**
 - e. Thickness: 1/8" (3.175 mm)
 - f. Preformed inside and outside corners.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's requirements as published in manufacturer's Installation instructions.
- B. Adhesive: As recommended by manufacturer.
- C. Caulking: As recommended by manufacturer.

3.02 EXAMINATION

- A. Site Verification of Conditions: Confirm substrate conditions (which have been previously addressed under other sections) are acceptable for product installing in accordance with manufacturer's instructions.
- B. Material Inspection: In accordance with manufacturer's installing requirements, visually inspect materials prior to installing. Material with visual defects shall not be installed.

SECTION 096500 - RESILIENT WALL BASE (Continued):

3.03 PREPARATION

- A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage while installing.
- B. Substrate Preparation: Prepare substrate to be smooth, rigid, flat, level, permanently dry, clean and free of foreign materials such as paint, dust, grease, oils, solvent, old adhesive residue, vinyl wall coverings, non-porous surfaces and all other contaminants that may interfere with adhesive bond.
- C. Do not install over existing floor covering or over substrates not approved by manufacturer.

3.04 INSTALLING

- A. Refer to manufacturer's installation instructions for specific resilient wall base detailed specifications on installing.
 - 1. Accessories: Architect shall specify manufacturers' color coordinated accessories as required, including (but not limited to) resilient transition strips and reducers.

3.05 FIELD QUALITY REQUIREMENTS

- A. Manufacturer's Field Services: Upon Owner's request and with minimum 72 hours notice, provide manufacturer's field service consisting of product use recommendations and periodic site visits to confirm installing of product is in accordance with manufacturer's instructions.

3.06 PROTECTION

- A. Protection: Protect installed product and finish surfaces from damage during construction. Remove and legally dispose of protective covering at time of substantial completion.
- B. Restrict cleaning for first 72 hours.

3.07 INITIAL MAINTENANCE PROCEDURES

- A. General: Include in contract sum cost for initial maintenance procedures and execution by professional maintenance personnel after resilient wall base has been installed for 72 hours as specified in the manufacturer's maintenance instructions.

3.08 CLEANING

- A. Cleaning: See manufacturer's maintenance instructions. Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of.

END OF SECTION 096500

SECTION 096519 - LUXURY VINYL TILE

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

- A. Section Includes:
 - 1. Luxury vinyl floor tile.

1.03 SUBMITTALS:

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units of each color and pattern of floor tile required.
- C. Qualification Data: For qualified Installer.
- D. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.04 QUALITY ASSURANCE

- A. Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation indicated.
 - 1. Engage an installer who employs workers for this Project who are trained for installation techniques required.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 65 deg F or more than 85 deg F. Store floor tiles as recommended by manufacturer.

1.06 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 85 deg F, in spaces to receive floor tile during the following time periods:
 - 1. 7 days before installation.
 - 2. During installation.
 - 3. after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 85 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

1.08 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

SECTION 096519 – LUXURY VINYL TILE (continued):

1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.01 LUXURY VINYL TILE - LVT

- A. Manufacturer: Interface
Series: Studio Set
Contact: Katherine Thomas (251) 709-2334.
- B. Class/ASTM F1700: Class III, Printed Vinyl Plank
- C. Wear layer thickness: 22 mil
- D. Total thickness: 4.5 mm
- E. Backing class: Commercial grade
- F. Finish: Ceramor
- G. Nominal dimensions: 25 cm x 1 m (9.845 in. x 39.38 in.)
- H. Warranty: 15 year standard LVT warranty
- I. Installation: See Interface LVT installation guidelines
- J. Maintenance: See Interface LVT maintenance guidelines

2.02 PERFORMANCE SPECIFICATIONS

- A. IIC Sound Rating: ASTM E492-09 – 57 IIC
- B. Slip Resistance: ASTM D2047 – greater than 0.55 wet/dry, ADA compliant
- C. Static Load Limit: ASTM F970 – 1500 psi
- D. Flexibility: ASTM F137 – Passes
- E. Resistance to Heat: ASTM F1514 – Passes
- F. Resistance to Light: ASTM F1515 – Passes
- G. Radiant Flux: ASTM E648 - Class 1
- H. Smoke Density: ASTM E662 – less than or equal to 450
- I. Size and squareness: ASTM F2055 – Passes, +/- 0.016 in. per linear foot
- J. Thickness: ASTM F386 – Passes
- K. Dimensional Stability: ASTM F2199 – Passes
- L. Residual Indentation: ASTM F1914 – Passes
- M. Resistance to Chemicals: ASTM F925 – Passes

SECTION 096519 – LUXURY VINYL TILE (continued):

2.03 ENVIRONMENTAL SPECIFICATIONS

- A. Indoor Air Quality: FloorScore/CDPH 01350 Certified for Low-VOC emissions
- B. Material Composition: Free of Ortho Phthalates, Added Formaldehyde and Heavy Metal Stabilizers
- C. Ingredients and Life Cycle Impacts: Environmental Product Declaration
- D. Carbon Footprint: 3rd Party Verified Carbon Neutral
- E. Sustainability Assessment: NSF/ANSI 332 Silver
- F. End of Life: Fully Recyclable LVT to Carpet Tile Backing

2.03 INSTALLATION MATERIALS

- A. Leveling and Patching Compounds: Portland based formulation approved by manufacturer for applications indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. All substrates to receive resilient flooring shall be dry, clean, smooth and structurally sound. They shall be free of dust, solvent, paint, wax, oil, grease, residual adhesive, adhesive removers, curing, sealing, hardening/parting compounds, alkaline salts, excessive carbonation/laitance, mold, mildew and other foreign materials.
- C. Areas to receive resilient flooring should be adequately illuminated during all phases of the installation process.
- D. Do not install resilient flooring products until the work area can be temperature controlled.
- E. The permanent HVAC system must be operational and functional and set to a minimum of 65 degrees F or a maximum of 85 degrees F for a minimum of 7 days prior to, during, and after installation. Once the installation is complete, the temperature should not exceed 85 degrees F.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Before installing resilient flooring over new or existing concrete subfloor, you must test the moisture and alkalinity levels of the concrete. All concrete substrates should be tested for moisture by use of the in Situ Probe RH test method (ASTM F 2170) and pH following ASTM F710 guidelines.
 - 1. Moisture Testing: Perform tests recommended by manufacturer **and as follows**. Proceed with installation only after substrates pass testing. Testing shall be done by an independent third party. Results shall be documented and retained. A copy shall be submitted to the Architect, Contractor and Flooring Subcontractor within 72 hours.
- C. TacTiles Installation: For projects equal to or less than 540 sf, Interface TacTiles connectors may be used.

SECTION 096519 – LUXURY VINYL TILE (continued):

1. Over concrete with up to 85% RH and pH up to 9.0, you may install with Interface's TacTiles connectors. Standard installation instruction apply.
 2. Over concrete with up to 90% RH and pH up to 9.0, you may install with Interface's TacTiles connectors provided the following conditions are met:
 - a. The concrete slab must be a new, bare concrete less than one year old from date of pour.
 - b. The slab must be on or above grade.
 - c. On grade slabs must have a functional vapor barrier under the entire slab.
 - d. An above grade slab must be a suspended slab or be poured in a vented pan.
 3. Over concrete with up to 97% RH and pH up to 11.0, you may install with Interface's TacTiles connectors in conjunction with XL Brands 9511 Moisture Vapor Reduction System. All XL Brands 9511 written requirements for product application, including, but not limited to, moisture and pH testing protocols, must be met or the resilient tile products will not be covered by warranty.
- D. New and existing concrete subfloors should meet the guidelines of the latest edition of ACI 302 and ASTM F710, "Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring".
- E. Levelness: Concrete floors shall be flat and smooth within 1/8" in 6 feet or 3/16" in 10 feet.
- F. Expansion and isolation joints in concrete are designed to allow for the expansion and contraction of the concrete. Resilient flooring products should never be installed over expansion joints. Expansion joint covers designed for use with resilient floor coverings should be used. Control joints (saw cuts) may be patched and covered with resilient once the concrete is thoroughly cured, dry and acclimated.
- G. Old Adhesive Residue must be dealt with in one of two ways:
1. It may be mechanically removed by methods such as: sanding, grinding, bead blasting or scarifying. Encapsulate the residual with XL Brands TriSeal or similar product specifically designed for adhesive encapsulation.
 2. A self-leveling Portland based underlayment may be applied over it. Check with a substrate manufacturer for suitability, application instruction and warranties. Never use solvents or citrus adhesive removers to remove old adhesive residue. Solvent residue left in/on the substrate may affect the new adhesive and floor covering.

3.03 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
1. Lay tiles carefully, noting directional arrows on the back of tiles when present.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, non-staining marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between

SECTION 096519 – LUXURY VINYL TILE (continued):

pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

3.04 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Remove soil, visible adhesive, and surface blemishes from floor tile surfaces.
 - 1. Not less than 48 hours after installation, clean floor with a neutral liquid cleaner, as recommended by the flooring and cleaner manufacturers.

END OF SECTION 096500

SECTION 096723 – RESINOUS FLOORING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Coating systems for food and beverage facilities, correctional facilities, pharmaceutical processing areas, and commercial and restaurant kitchen concrete floors. Developed for low odor and quick return to service. Excellent resistance to thermal shock and aggressive cleaning methods required to meet hygienic standards.

1.02 RELATED SECTIONS

- A. Section 033000 for under-slab-vapor barrier.

1.03 REFERENCES

- A. ASTM D 16 - Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
- B. ASTM D 4259 – Standard Practice for Abrading Concrete.
- C. ASTM D 4263 - Indicating Moisture in Concrete by the Plastic Sheet Method.
- D. ASTM F 2170 - Relative Humidity Test using in situ probes.
- E. International Concrete Repair Institute (ICRI) Guideline No. 03732 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
- F. SSPC-SP 13/NACE 6 - Surface Preparation of Concrete.

1.04 DEFINITIONS

- A. Definitions of Painting Terms: ASTM D 16, unless otherwise specified.
- B. Dry Film Thickness (DFT): Thickness of a coat of paint in fully cured state measured in mils (1/1000 inch).

1.05 SUBMITTALS

- A. Comply with Section 013000 - Submittals.
- B. Product Data: Submit manufacturer's product data for each coating, including generic description, complete technical data, surface preparation, and application instructions.
- C. Color Samples: Submit manufacturer's color samples showing full range of standard colors.
- D. Manufacturer's Quality Assurance: Submit manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.
- E. Applicator's Quality Assurance: Submit list of a minimum of 5 completed projects of similar size and complexity to this Work. Include for each project:
 - 1. Project name and location.
 - 2. Name of owner.
 - 3. Name of contractor.
 - 4. Name of architect.
 - 5. Name of coating manufacturer.
 - 6. Approximate area of coatings applied.
 - 7. Date of completion.

SECTION 096723 – RESINOUS FLOORING (continued):

- F. Warranty: Submit manufacturer's standard warranty.

1.06 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
1. Specialize in manufacture of coatings with a minimum of 5 years successful experience.
 2. Able to demonstrate successful performance on comparable projects.
 3. Single Source Responsibility: Coatings and coating application accessories shall be products of a single manufacturer.
- B. Applicator's Qualifications:
1. Experienced in application of specified coatings for a minimum of 5 years on projects of similar size and complexity to this Work.
 2. Applicator's Personnel: Employ persons trained for application of specified coatings.
- C. Mock-Ups: Prepare 10 foot x 10 foot mock-up for each coating system specified using same materials, tools, equipment, and procedures intended for actual surface preparation and application. Obtain Architect's approval of mock-ups. Retain mock-ups to establish intended standards by which coating systems will be judged.
- D. Pre-application Meeting: Convene a pre-application meeting Two (2) weeks before start of application of coating systems. Require attendance of parties directly affecting work of this section, including Contractor, Architect, applicator, and manufacturer's representative. Review the following:
1. Environmental requirements.
 2. Protection of surfaces not scheduled to be coated.
 3. Surface preparation.
 4. Application.
 5. Repair.
 6. Field quality control.
 7. Cleaning.
 8. Protection of coating systems.
 9. One-year inspection.
 10. Coordination with other work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:
1. Coating or material name.
 2. Manufacturer.
 3. Color name and number.
 4. Batch or lot number.
 5. Date of manufacture.
 6. Mixing and thinning instructions.
- B. Storage:
1. Store materials in a clean dry area and within temperature range in accordance with manufacturer's instructions.
 2. Keep containers sealed until ready for use.
 3. Do not use materials beyond manufacturer's shelf life limits.
- C. Handling: Protect materials during handling and application to prevent damage or contamination.

1.08 ENVIRONMENTAL REQUIREMENTS

SECTION 096723 – RESINOUS FLOORING (continued):

- A. Weather:
 - 1. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
 - 2. Surface Temperature: Minimum of 5°F (3°C) above dew point.
 - 3. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.
- B. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with manufacturer's instructions.
- C. Dust and Contaminants:
 - 1. Schedule coating work to avoid excessive dust and airborne contaminants.
 - 2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Tnemec Coatings as represented by Florida Protective Coatings Consultants, 250 Waymont Ct, ste 120, Lake Mary, FL 32746 Phone (407) 322-1243. Fax (407) 322-1245. E-Mail: bpasseser@tnemec.com (Barry Passeser – 386-689-3083) Web Site www.tnemec.com. OR Approved Equal.
- B. Alternate materials to be considered for this project must be submitted at least 14 days prior to the bid opening with equivalent performance test data. Required substitution data includes the following:
 - 1) Product specification.
 - 2) Warranty information.
 - 3) Repair details.
 - 4) List of three comparative installations, in use three or more years.
 - 5) Contact information for performance reference checks.

2.02 COATINGS

- A. **RFL**: Medium use commercial and 6" Cove Base
 - 1. Laminate Resinous Flooring: Tnemec Series 222 Deco-Tread consisting of a two-component modified polyamine cured water clear epoxy liquid and a colored quartz broadcast aggregate applied by double broadcast or as a slurry broadcast to provide a minimum 1/8" thickness.
 - 2. Apply Series 241 Ultra-Tread MVT at 1/8" thickness. This is a primer and first coat. Broadcast quartz aggregate to refusal. Apply Tnemec Series 222 Deco-tread to 20 mills. Broadcast quartz aggregate to refusal. Surface preparation should be a minimum ICRI CSP5.
 - 3. Grout Coat: Tnemec Series 284 Deco-Clear at 6-12 mils dft.
 - 4. Finish Coat: Tnemec Series 285 Satin glaze, a two-component, polyamine cured water clear epoxy finish. Provides a satin finish and orange peel texture when applied over Series 284 Deco-Clear.
 - 5. Second Finish Coat: For additional gloss, color retention and abrasion resistance, install a finish coat of Tnemec Series 294 Clear CRU for a semi-gloss finish.
 - 6. Coving: Series 222 Deco-Tread, a two-component, modified polyamine cured epoxy liquid, blended as a mortar with decorative aggregate applied to form a cant or rolled radius cove. Base shall be 6" high.
 - 7. Use a PCS Joint, premolded plastic termination strip, from KEP, Inc., or engineer approved equal at the top of 6" Cove Base.
- C. **Installation:**
 - 1. Install Cove Base before proceeding.
 - a. Surface prepare areas to receive cove base by mechanical means to obtain a minimum ICRI CSP3.

SECTION 096723 – RESINOUS FLOORING (continued):

- b. Apply 1 coat of Tnemec Series 201 Epoxyoprim at 6.0 - 8.0 mils dft. Lightly "dust" into the wet material a small amount of aggregate to facilitate the application of the cove base.
 - c. Provide a "rolled radius" cove base. Use Tnemec Series 237 Power-Tread (or Tnemec Series 222 Deco-Tread) mixed with 30 - 50 mesh aggregate at an approximate ratio of 6-9 parts aggregate to 1 part resin ratio.
2. Fill all cracks, depressions and recessed joints, such as control and construction joints with Tnemec Series 201 Epoxoprim mixed with fumed silica or Tnemec Series 245 Ultra-Tread mixed with an aggregate. When filled, the area should be flush with the floor surface.
3. Terminations such as perimeter drains, trenches, etc. must be keyed to provide anchorage. A key is achieved by cutting a 1/2" wide by 1/2" deep channel into the substrate. Do not feather edge Series 245.
4. A minimum ICRI CSP 5 is required.
5. Tnemec Series 245 Ultra Tread S is supplied as a 4 part mix and is applied as a slurry. Mix all components per the manufacturer's instructions. Pour the mixed material onto the floor and spread to achieve a uniform thickness and coverage per the product data sheet. Apply and "push" to the cove base.
6. Using a porcupine or loop roller, backroll through the material to help facilitate leveling and alleviate imperfections.
7. Immediately broadcast the aggregate specified to refusal.
8. Remove excess aggregate after the material has cured and can support the weight of the workers.
9. Follow the manufacturer's printed instructions for recoat times.
10. Apply Tnemec Series 246 Ultra Tread Glaze at 8.0 - 10.0 mils per coat over the entire floor including the cove base.

2.03 ACCESSORIES

- A. Coating Application Accessories:
 1. Accessories required for application of specified coatings in accordance with manufacturer's instructions, including thinners.
 2. Products of coating manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which coating systems are to be applied. Notify Architect of areas or conditions not acceptable. Do not begin surface preparation or application until unacceptable areas or conditions have been corrected.

3.02 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

- A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.
- B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.03 SURFACE PREPARATION OF CONCRETE FLOORS

- A. Prepare concrete surfaces in accordance with manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 03732. Surface profile to be no less than an ICRI CSP 5.
- B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.
- C. Moisture Testing: Perform tests recommended by manufacturer **and as follows**. Proceed with installation only after substrates pass testing. Testing shall be done by an independent third party.

SECTION 096723 – RESINOUS FLOORING (continued):

- a. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum **90%** relative humidity level measurement.
 - b. Results shall be documented and retained. A copy shall be submitted to the Architect, Contractor and Flooring Subcontractor within 72 hours.
- D. Allow new concrete to cure for a minimum of 10 days before coating.
- E. Level protrusions and mortar spatter.
- F. Saw cut all perimeters and terminations

3.04 APPLICATION

- A. Apply coatings in accordance with manufacturer's instructions.
- B. Fill large voids in surface with either TNEMEC Series 218 MortarClad epoxy cement. Series 243 Ultra-Tread V or Tnemec Series 245 as required.
- C. Mix coatings in accordance with manufacturer's instructions.
- D. Keep containers closed when not in use to avoid contamination.
- E. Do not attempt to remixed or apply coatings beyond pot life limits.
- F. Use application equipment, tools, and techniques in accordance with manufacturer's instructions.
- G. Uniformly apply coatings at spreading rate required to achieve specified DFT.
- H. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.
- I. Refer to Tnemec' Guideline for the application of Polyurethane Modified Concrete's.

3.05 REPAIR

- A. Materials and Surfaces Not Scheduled To Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.
- B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.
- C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.06 FIELD QUALITY CONTROL

- A. Inspector's Services:
 - 1. Verify coatings and other materials are as specified.
 - 2. Verify surface preparation and application are as specified.
 - 3. Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gauges.
 - 4. Coating Defects: Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.
 - 5. Report:
 - a. Submit written reports describing inspections made and actions taken to correct nonconforming work.

SECTION 096723 – RESINOUS FLOORING (continued):

- b. Report nonconforming work not corrected.
 - c. Submit copies of report to Architect and Contractor.
- B. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

3.07 **CLEANING**

- A. Remove temporary coverings and protection of surrounding areas and surfaces.

3.08 **PROTECTION OF COATING SYSTEMS**

- A. Protect surfaces of coating systems from damage during construction.

3.09 **ONE-YEAR INSPECTION**

- A. Owner will set date for one-year inspection of coating systems.
- B. Inspection shall be attended by Owner, Contractor, Architect, and manufacturer's representative.
- C. Repair deficiencies in coating systems as determined by Architect in accordance with manufacturer's instructions.

END OF SECTION 096723

SECTION 099100 – PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and Division 1 Specification Sections, apply to this section.

1.02 DESCRIPTION OF WORK

- A. Painting and finishing of interior and exterior items and surfaces, unless otherwise indicated.
- B. Includes field painting of bare and covered pipes and ducts (including color coding), and hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work.
- C. Paint exposed surfaces, except as otherwise indicated, whether or not colors are designated. If not designated, colors will be selected by Architect from designer colors available for the coatings required.
- D. See Section 099600 for textured coatings to be utilized on the exterior of the building.

1.03 WORK NOT INCLUDED: Unless otherwise indicated, shop priming of ferrous metal items and fabricated components are included under their respective trades. Pre-finished items, are not included.

- A. Unless otherwise indicated, painting not required on surfaces of concealed areas except for piping, equipment and other such items within concealed spaces. Finished metals such as anodized aluminum, stainless steel, bronze, and similar metals will not be painted. Do not paint any moving parts of operating units, or over any equipment identification, performance rating, name or nomenclature plates or code-required labels.

1.04 RELATED SECTIONS

- A. Section 064023 - Interior Architectural Woodwork
- B. Section 081113 - Steel Doors and Frames
- C. Section 092900 - Gypsum Drywall

1.05 FLAME SPREAD RATING

- A. Class A (0-25) over non-combustible surfaces.

1.06 SUBMITTALS: In addition to manufacturer's data, application instructions, and label analysis for each coating material, submit samples for Architect's review of color and texture only. Resubmit samples if requested until required sheen, color and texture is achieved.

- A. On 8" x 8" hardboard, provide samples of each color and material, with texture to simulate finish conditions.
- B. On actual wall surfaces and other building components, duplicate painted finishes of acceptable samples, as directed by Architect. Final acceptance of paint color and texture shall be from wall sample.

SECTION 099100 - PAINTING (continued):

1.07 PROJECT CONDITIONS

- A. Do not apply paint in rain, fog or mist or when relative humidity exceeds 85%. Do not apply paint to damp or wet surfaces or before the building is weathered in.

1.08 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner. Furnish Owner with 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Provide specified paint by Sherwin-Williams Company OR approved equal by one of the following paint manufacturers:
1. PPG.
 2. Benjamin Moore.

2.02 PAINT MATERIALS – GENERAL

- A. **Material Compatibility:** Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates recommended by manufacturer.
- B. **Material Quality:** Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

2.03 PAINT SCHEDULE

A. **Exterior Surfaces:**

1. **Galvanized Metal (Exterior): Semi-Gloss Finish**
NOTE: See below for hollow metal doors & frames and handrails.
1st Coat: S-W PRO Industrial Acrylic Semi-Gloss Coating, B66-650 Series
2nd Coat: S-W PRO Industrial Acrylic Semi-Gloss Coating, B66-650 Series
(2.5-4 mils dry per coat; VOC 0 g/L)
2. **Metal: Hollow Metal Doors & Frames and Handrails: Semi-Gloss Finish**
1st Coat: S-W PRO Industrial Pro-Cryl Universal Metal Primer; B66 Series
2nd Coat: S-W PRO Industrial Waterbased Alkyd Urethane; B53-1150 Series
3rd Coat: S-W PRO Industrial Waterbased Alkyd Urethane; B53-1150 Series
(1.4-1.7 dry mils per coat)
3. **Ferrous Metal (Exterior) (Shop Primed Metal): Semi-Gloss Finish**
1st Coat: S-W PRO Industrial Acrylic Semi-Gloss Coating, B66-650 Series
2nd Coat: S-W PRO Industrial Acrylic Semi-Gloss Coating, B66-650 Series
(2.5-4 mils dry per coat; VOC 0 g/L)
4. **Concrete Masonry Units: Satin Finish**
1st Coat: Loxon block surfacer, A24W200
2nd coat: Loxon Self-cleaning satin finish, LX 14 series
3rd coat: Loxon Self-cleaning satin finish, LX 14 series

B. **Interior Surfaces:**

1. **Gypsum Drywall (Interior):**
1st Coat: S-W ProMar 200 Zero VOC Latex Primer, B28W2600
(4 mils wet, 1.5 mils dry; Zero VOC)
2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series
(4 mils wet, 1.6 mils dry per coat; Zero VOC)

SECTION 099100 - PAINTING (continued):

2. **Gypsum Drywall (Wet Areas or where EP-Epoxy Paint is scheduled on the Finish Plans): Semi-Gloss Finish**
1st Coat: S-W ProGreen 200 Interior Latex Primer, B28W600
(4 mils wet, 1.5 mils dry; VOC 49 g/L, 0.36 lb/gal)
2nd Coat: S-W ProIndustrial Pre-Catalyzed Waterbased Epoxy, K46
3rd Coat: S-W ProIndustrial Pre-Catalyzed Waterbased Epoxy, K46
(4.0 mils wet, 1.5 mils dry per coat; VOC 155 g/L, 1.29 lb/gal)
3. **Concrete Masonry Units and Concrete (Interior): Semi-Gloss Finish**
1st Coat: S-W PrepRite Blockfiller , B25W25
(VOC , 50 g/L)
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-gloss, B31-2600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-gloss, B31-2600 Series
(4 mils wet, 1.6 mils dry per coat; Zero VOC)
4. **Concrete Masonry Units (Where EP-Epoxy Paint is scheduled on finish plans):**
1st Coat : S-W Loxon Block Surfer, A24W200
(50-100 sq ft/gal; VOC 81 g/L, 0.68 lb/gal)
2nd Coat: S-W ProIndustrial Pre-Catalyzed Waterbased Epoxy, K46
3rd Coat: S-W ProIndustrial Pre-Catalyzed Waterbased Epoxy, K46
(4.0 mils wet, 1.5 mils dry per coat; VOC 155 g/L, 1.29 lb/gal)
5. **Concrete Floors (Where EFC - Epoxy Floor Coating is scheduled):**
1st Coat: AS1000 HS, B67-2000 Series, reduced 1 pt per gallon with R7K54
Solvent (2.5-4.0 dry mils)
2nd Coat: AS1000 HS, B67-2000 Series (2.5-4.0 dry mils)
6. **Galvanized Metal (Interior):**
NOTE: See below for hollow metal doors & frames and handrails.
Primer: S-W Pro-Cryl Universal Primer, B66-310 Series
(5.0-10.0 mils wet, 2.0-4.0 mils dry; VOC <100 g/L, <0.93 lb/gal)
1st Coat: S-W PRO Industrial Acrylic Semi-Gloss Coating, B66-650 Series
2nd Coat: S-W PRO Industrial Acrylic Semi-Gloss Coating, B66-650 Series
(2.5-4 mils dry per coat; VOC 0 g/L)
7. **Metal: Hollow Metal Doors & Frames and Handrails (Semi-Gloss Finish):**
1st Coat: S-W PRO Industrial Pro-Cryl Universal Metal Primer; B66 Series
2nd Coat: S-W PRO Industrial Waterbased Alkyd Urethane; B53-1150 Series
3rd Coat: S-W PRO Industrial Waterbased Alkyd Urethane; B53-1150 Series
(1.4-1.7 dry mils per coat)
8. **Ferrous Metal (Interior):**
Primer: S-W Pro-Cryl Universal Primer, B66-310 Series
(5.0-10.0 mils wet, 2.0-4.0 mils dry; VOC <100 g/L, <0.93 lb/gal)
1st Coat: S-W PRO Industrial Acrylic Semi-Gloss Coating, B66-650 Series
2nd Coat: S-W PRO Industrial Acrylic Semi-Gloss Coating, B66-650 Series
(2.5-4 mils dry per coat; VOC 0 g/L)

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.
 1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.
 3. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

SECTION 099100 - PAINTING (continued):

3.02 PREPARATION

- A. Remove hardware and accessories, machined surfaces, plates, lighting fixtures and similar items in place and not to be finish-painted or provide surface-applied protection. Reinstall removed items and remove protective coverings at completion of work.
- B. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
 - Cementitious Surfaces: Prepare concrete, concrete masonry, cement plaster and surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation. Determine alkalinity and moisture content of surfaces to be painted. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
- 2. Wood: Clean surfaces of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth, and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After primer, fill holes and imperfections in finish surfaces with putty or plastic wood filler.
Sand
 - b. Prime, stain, or seal wood to be painted immediately upon delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.
 - c. Seal tops, bottoms, and cut-outs of unprimed wood doors with a heavy coat of varnish or sealer immediately upon delivery.
- C. Ferrous Metals: Clean non-galvanized ferrous metal surfaces that have not been shop-coated; remove oil, grease, dirt, loose mill scale and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council. Touch-up shop-applied prime coats that have been damaged, and bare areas. Wire-brush, clean with solvents and touch-up with the same primer as the shop coat.
- D. Galvanized Surfaces: Clean galvanized surfaces with non-petroleum based solvents so that surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock, by mechanical methods.
- E. Material Preparation: Mix and prepare paint materials according to Manufacturer's written instructions.

3.03 APPLICATION:

- A. Apply painting and finishing materials in accordance with manufacturer's directions. Use applicators, and techniques best suited for materials and surfaces to which applied.
- B. Apply additional coats when undercoats, stains or other conditions show through final paint coat, until paint film is of uniform finish, color and appearance.
- C. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before equipment is installed.
- D. Paint interior surfaces of ducts, where visible through registers or grilles, flat, non-specular black.
- E. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.
- F. Sand lightly between exceeding enamel or varnish coats.

SECTION 099100 - PAINTING (continued):

- G. Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise specified.
- H. Apply prime coat to material which is required to be painted or finished, and which has not been prime coated by others.
- I. Apply each material at not less than manufacturer's recommended spreading rate, to provide a total dry film to thickness of not less than 4.0 mils for entire coating system of prime and finish coats for 3-coat work.
- J. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

3.05 **PROTECTION:**

- A. Protect work of other trades. Correct any painting related damages by cleaning, repairing or replacing, and refinishing, as directed by Architect.

3.06 **COORDINATION:**

- A. Provide finish coats which are compatible with prime paints used. Provide barrier coats over incompatible primers where required. Notify Architect in writing of anticipated problems using specified coatings with substrates primed by others.

3.07 **COMPLETED WORK**

- A. Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

END OF SECTION 099100

SECTION 099601 - HIGH PERFORMANCE COATINGS FOR EXTERIOR EXPOSED CONCRETE

PART 1 – GENERAL

1.01 SUMMARY

- A. This Section includes applying special coating systems to items and surfaces scheduled, including surface preparation, prime coats, and topcoats for exterior painting.
- B. Types of Special Coatings for exterior use as indicated on the drawings and schedules include the following:
 - 1. High build, multifunctional acrylic primer
 - 2. Infrared heat-reflective water based exterior coating that incorporates Kynar Aquatec® technology.
- C. Related Work:
 - 1. Documents affecting work of this Section include, but are not limited to, General Conditions, Supplementary Conditions, Sections in Division 1 of these Specifications, and including the following Divisions:
 - a. Division 3 – Cast-in-Place & Precast Concrete

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM B 117 Standard Test Method for Corrosion Resistance.
 - 2. ASTM D 2240 Standard Test Method for Measuring Shore Hardness.
 - 3. ASTM D 2794 Standard Test Method for Measuring Direct Impact.
 - 4. ASTM D 3359 Standard Test Methods for Measuring Adhesion by Tape Test.
 - 5. ASTM D 3363 Standard Test Method for Film Hardness by Pencil Test.
 - 6. ASTM D 4060 Standard Test Method for Abrasion Resistance.
 - 7. ASTM D 4213 Standard Test Method for Measuring Scrub-ability of Coatings.
 - 8. ASTM D 4258 Standard Practice for Surface Cleaning Concrete for Coating.
 - 9. ASTM D 4259 Standard Practice for Abrading Concrete.
 - 10. ASTM D 4261 Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating.
 - 11. ASTM D 4263 Standard Test Method for Indicating Moisture by the Plastic Sheet Method.
 - 12. ASTM D 4541 Standard Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers.
 - 13. And various other ASTM test standards.
- B. Steel Structures Painting Council (SSPC):
 - 1. Steel Structures Painting Council Surface Preparation Specifications (SSPC-SP)
 - 2. Steel Structures Painting Council Paint Application Specifications (SSPC-PA)

1.03 DEFINITIONS

- A. Definitions as used in Finish Schedule shown on Drawings and Coating Schedule included herein.
 - 1. Coatings: Paint or heavy duty finishes for use on surfaces subject to interior and exterior exposure, submergence, high moisture, splash, or chemical environment, including primers, sealers, fillers, and intermediate and finish coats.
 - 2. Normal: Surfaces subject to normal temperature and humidity.
 - 3. First Coat: Field primer, factory primer, or shop primer. When only one coat is required, first coat is the finish coat.
 - 4. Second, Third, Intermediate, or Finish coats: Successive finish coats applied over first coat.

5. DFT: Dry Film Thickness (Mils/coat).
6. Sfpg: Square feet per gallon (per coat).

1.04 SUBMITTALS

A. Product Data:

1. To be considered for approval all submittals shall include the following: Manufacturer's product data sheets, product performance criteria, generic chemistry of each coating, and application recommendations for each coating scheduled.
2. List each material and cross-reference the specific coating, finish system, and application.

B. Submit one copy of manufacturer's Material Safety Data Sheets (MSDS) for each type of coating to ARCHITECT'S field office for information. CONTRACTOR shall post a copy of MSDS on the Site at all times when coating is in progress.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements:

1. All coatings shall conform to OSHA requirements for allowable exposure to lead and other hazardous substances.

B. Product Manufacturer:

1. Manufacturer shall be a company that specializes in producing high quality industrial coating materials. This company shall have 30 years or more experience demonstrated by case histories in the designated field of application.

C. Applicator Qualifications:

1. Engage an experienced applicator with 5 years or more experience who has successfully completed coating system applications similar in material and extent to those indicated.

D. Single-Source Responsibility:

1. Provide coating material produced by the same manufacturer for each system.

E. Performance Testing:

1. The OWNER/ARCHITECT may request testing from the manufacturer for required performance that may include but is not limited to adhesion to the substrate and between coating layers, and resistance to abrasion, humidity, freeze/thaw, and Ultra-violet light exposure.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to the site in original containers with labels intact and seals unbroken.

B. Protect and heat or cool material storage location to maintain temperature ranges recommended by coating manufacturers, but not less than 50 degrees F.

C. Oily rags and waste must be removed from buildings each night or kept in appropriate metal containers. Provide fire extinguishers of the type recommended by coating manufacturers in

areas of storage and where finishing is occurring. Allow no smoking or open containers of solvent.

D. Empty containers shall have labels canceled and clearly marked as to use.

1.07 PROJECT / SITE CONDITIONS

A. Environmental Requirements:

1. Use indirect-fired dry heat and ventilate areas to obtain conditions recommended by coating manufacturer.
2. Relative humidity conditions as specified by coating manufacturer shall be adhered to.
3. No unprotected, unheated exterior coating shall be undertaken when cold damp, foggy, or rainy weather appears probable, nor when the temperature of the substrate is below 50 degrees F, unless listed in this specification or approved in writing by the coating manufacturer.
4. Maintain the manufacturer's environmental requirements until the coating is fully cured.
5. Apply no coating in areas where dust is being generated.
6. Testing and disposal of any waste and coating shall be the responsibility of the CONTRACTOR.

B. Protection:

1. Drop cloths shall be provided in all areas where coating is performed to fully protect other surfaces.
2. Remove hardware, accessories, plates, lighting fixtures, and similar items or provide protection by masking. Upon completion, replace items or remove protection and clean.

C. Upon Substantial Completion, remaining unused material will become property of the OWNER. Seal material as required for storage, mark contents with color, type, location, and shelf life, and store on Site where required by the OWNER. Provide a minimum of two gallons of each system component and color used.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Tex-Cote, LLC (A subsidiary of Tnemec Company)

2422 E. 15th Street
Panama City, Florida 32405
Tex-Coat Coolwall® with Kynar® and Infrared Reflective Pigments

Technical information may be obtained from the following:
SteelCon Coating Systems, Inc.
2100 3rd Ave South
Irondale, Alabama 35210
Phone: 205-951-2086
E Mail: crumbaugh@steelconcoatings.com

B. Or approved equal

2.02 SPECIAL COATING MATERIALS

A. Special Coating products of Tex-Cote, LLC. are listed in the Coating Schedule as a standard of quality and performance, and it is not the intent of the specifier that these materials are to be used to the exclusion of equivalent products of other manufacturers.

- B. Only coatings that meet or exceed the performance of these specified coatings may be submitted for use. No substitutions will be considered that change the generic chemistry of the coatings specified.
- C. No substitution will be considered unless the Architect/Owner has received a written request for approval at least 10 days prior to the bid date for receipt of bids. Each request shall include the name of the specified material for which a substitute is being requested; name of the proposed substitute material; and a complete description of the proposed substitute including performance & test data, cure times, recoat windows, and generic composition. No request for substitution will be considered that would decrease film thickness or offer a change in the generic type of coating specified. The decision of the Architect/Owner regarding approval or disapproval of the proposed substitution shall be final.

2.03 COLORS, MIXING, AND THINNING

- A. Color shall be formed of pigments free of lead, lead compounds, or other materials that might be affected by the presence of hydrogen sulfide or other gases likely to be present at the Site.
- B. Where thinning is necessary, only the products of the manufacturer furnishing the coating will be allowed. All such thinning shall be done in strict accordance with the coating manufacturer's recommendations.
- C. Mix in accordance with the manufacturer's recommendations.

2.04 SOURCE QUALITY

- A. Source Quality: Obtain painting, coating, and thinning materials from a single manufacturer.

PART 3 – EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including technical information, catalogue instructions, and product instructions listed on material containers.

3.02 EXAMINATION

- A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to the timely and proper completion of the work. Materials removed and replaced to correct defects due to errant application such as overspray or drips on unsuitable surfaces shall be at the CONTRACTOR'S expense.

3.03 SURFACE PREPARATION

- A. General:
 - 1. All surfaces to be coated shall be prepared as specified herein and in accordance with the coating manufacturer's recommendations. The object shall be to obtain a uniform, clean, and dry surface.
 - 2. Quality of surface preparation described herein is considered a minimum. If the coating manufacturer requires a higher degree of preparation, comply with the coating manufacturer's recommendations.
 - 3. Where surface dryness is questioned, test with a dampness-indicating instrument. Do not apply coatings over surfaces where moisture content exceeds that permitted by the coating manufacturer.
 - 4. Workmanship for surface preparation shall conform to the following Steel Structures Painting Council (SSPC) specification:

- a. Surface Preparation of Concrete:
 - i. SSPC-SP WJ4 Light Cleaning
 - ii. Take measures to ensure Tilt wall bond breaker and/or other agents have been removed from the Concrete surface

B.

C. Exterior Concrete:

1. Concrete must be at least 28 days old and shall pass a dryness test in accordance with ASTM D4263 Test Method for Indicating Moisture by the Plastic Sheet Method, before coating is applied.
2. Remove fins and other protrusions by grinding.
3. Repair surface defects and voids as recommended by the coating manufacturer.
4. Concrete surfaces, including pre-cast concrete, to be coated shall be cleaned of all form oil, curing compound, laitance, other foreign substances, and shall meet the cleanliness standard of ASTM D 4258 Standard Practice for Surface Cleaning Concrete for Coating.
5. Concrete surfaces shall be pressure washed in accordance with SSPC-SPWJ4 Light Cleaning.
6. All surfaces shall be clean and dry.

3.04 APPLICATION

- A. Surfaces shall be dry at the time of application.
- B. The minimum surface temperature shall be 50 degrees F and rising unless noted otherwise.
- C. Apply in strict accordance with the manufacturer's recommendations by brush, roller, spray, or other application method. The number of coats and thickness required is the same regardless of application method.
- D. Each coat shall be allowed to dry in accordance to the manufacturer's requirements. Drying time shall be construed to mean "under normal conditions." Where conditions other than normal exist, because of weather or because of confined space, longer times will be necessary.
- E. Coatings shall be applied to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, or other surface imperfections will not be acceptable. Areas cut-in by brush prior to rolling shall have uniform appearance in comparison to adjoining surfaces.
- F. Edges of coatings adjoining other materials or other colors shall be sharp and clean without overlapping.
- G. Crevices and other hard to apply areas shall be back-rolled/back-brushed in conjunction with the field-applied prime coat.
- H. Where multiple coats of the same material are applied, each undercoat shall be slightly different in shade to facilitate identifying each coat.

3.05 FINAL TOUCH-UP AND CLEANING

- A. Prior to substantial completion, examine the coated surfaces and retouch or refinish surfaces to leave in condition acceptable to the ARCHITECT/OWNER.
- B. Remove masking, coatings, and other material from floors, glass, and other surfaces not scheduled to be coated.

3.06 COATING SYSTEMS

- A. Scheduled thickness or coverage rate is the minimum as recommended by Tnemec Company, Inc. If another manufacturer is used, manufacturer's recommendations shall be followed, but in no case shall the thickness or coverage rate be less than scheduled.
- B. Coatings shall conform to the following schedule and coating manufacturer's recommendations. Examples of surfaces to be coated may not be all inclusive.

3.07 SCHEDULE OF COATING SYSTEMS FOR EXTERIOR SERVICE

*All coating thicknesses are expressed in dry film thickness (DFT.)

A. Exterior Concrete:

- 1. Surface Preparation: SSPC-SPWj 4 Light Cleaning to remove all dirt, dust, as well as any foreign matter. All surfaces shall be clean and dry. Allow new concrete, and masonry to cure 28 days.
- 2. Primer: Tex-Cote High Build Textured Primer (for a Sand Texture finish)
 - a. Coverage Rate: 60 - 80 sq. ft. per gallon
- 3. First Coat: Tex-Cote Cool Wall® with Kynar® IR Finish
 - a. Dry Film Thickness: 3.0 – 4.0 mils
- 4. Finish Coat: Tex-Cote Cool Wall® with Kynar® IR Finish
 - a. Dry Film Thickness: 3.0 – 4.0 mils.

Performance Requirements:

ASTM D4803-97 – Total Solar Reflectance:

ASTM C1305 – Crack Bridging

ASTME96 - Permeability

ASTM D6940 – Wind Driven Rain Resistance

ASTM D2565-99-T-1, C#4 – Accelerated Weathering – 5,000 hours

ASTM D3273/ D3274 – Mold and Mildew Resistance – 28 days.

3.08 WARRANTY

- A. Product Warranty: The Manufacturer shall warrant that the system will not chip, flake, or peel from the underlying surface to which it is applied. The material shall also be warranted for a period of ten (10) years not to fade beyond ten (10) Delta E CIE L*a*b* units from the original color at the time of application. Color change shall be determined in accordance ASTM D 2244.
- B. Applicator Warranty: The applicator shall warrant his workmanship for a period of 5 years from the date of completion. All defects in the coating system not covered by the manufacturer's warranty, shall be repaired at no additional cost to the Owner.

END OF SECTION 099601

SECTION 101000 - MARKERBOARDS AND TACKBOARDS

PART 1 - GENERAL

- 1.01 **Submittals**: Submit product data showing elevations and sections of trim members. Submit samples of tackboard fabric for selection of colors.
- 1.02 **Markerboard Warranty**: Furnish written warranty, agreeing to replace chalkboards that do not retain their original writing and erasing qualities, become slick and shiny, or exhibit crazing, cracking, or flaking, provided manufacturer's instructions with regard to handling, installation, protection, and maintenance have been followed. Warranty Period - 50 years.

PART 2 - PRODUCTS

- 2.01 **Porcelain Enamel Magnetic Markerboard**: Provide porcelain enamel steel magnetic markerboard of 3-ply construction consisting of face sheet, core material, and backing. Provide markerboard by Claridge Products and Equipment, Inc. OR approved equal.
- A. **Face Sheet**: 24-gage porcelain enamel magnetic steel
 - B. **Cover Coat**: Light-colored special writing surface with gloss finish for use with liquid felt-tipped markers. Color to be white.
 - C. **Core**: 3/8-inch-thick particleboard or fiberboard, as per manufacturer, ANSI A208.1, Grade 1-M-1.
 - D. **Backing Sheet**: 0.015-inch-thick aluminum sheet or 26-gage galvanized steel sheet.
 - E. **Laminating Adhesive**: Moisture-resistant thermoplastic adhesive.
- 2.02 **Cork Tackboards**: Provide mildew-resistant, washable, self-seaming, 1/4" thick cork sheet with 1/4" thick burlap on hardboard backing, "Claridge Cork" by Claridge Products and Equipment, Inc., Gold Seal Bulletin Board Cork by Forbo Industries, OR Newline Products, Inc. (NPI). Provide flame spread rating of 25 or less when tested in accordance with ASTM E 84. Color to be selected by the Architect from the manufacturer's full range of colors.
- 2.03 **Metal Trim and Accessories**: Fabricate frames and trim of not less than 0.062-inch-thick aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units wherever possible; keep joints to a minimum. Miter corners to a neat, hairline closure.
- A. Where size of boards or other conditions exist that require support in addition to the normal trim, provide structural supports or modify trim as indicated.
 - B. **Markertray**: Furnish manufacturer's standard continuous box-type aluminum markertray with slated front and cast aluminum end closures for each markerboard.
 - C. **Map Rail**: Furnish map rail at the top of each unit, complete with the following accessories:
 - D. **Display Rail**: Continuous cork display rail approximately 1 or 2 inches wide, as indicated, integral with the map rail.
 - E. **End Stops**: One end stop at each end of the map rail.
 - F. **Map Hooks**: 2 map hooks for each 4 feet of map rail or fraction thereof.
- 2.04 **Fabrication**: Laminate porcelain enamel facing sheet and backing sheet to core material with flexible, waterproof adhesive.

SECTION 101000 - MARKERBOARDS AND TACKBOARDS (continued):

- 2.06 Assembly: Provide factory-assembled units, except where field- assembled units are required. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of the board. Provide "hairline" vertical joint system between abutting sections of markerboard. Provide mullion trim at joints between markerboard and tackboard.
- 2.07 Finishes: Comply with NAAMM "Metal Finishes Manual."
Class II Clear Anodized Finish: AA-M12C22A31

PART 3 - EXECUTION

- 3.01 Installation: Deliver factory-built units completely assembled in one piece. Where dimensions exceed panel size, provide 2 or more pieces of equal length. When overall dimensions require delivery in separate units, prefabricate components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.
- 3.02 Install units in locations and mounting heights indicated in accordance with manufacturer's instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for a complete installation. Units shall be mechanically attached, the use of adhesives is allowed only in conjunction with mechanical fastening.
- 3.03 Coordinate job-site-assembled units with grounds, trim, and accessories. Join parts with a neat, precision fit.
- 3.04 Clean in accordance with manufacturer's instructions.

END OF SECTION 101000

SECTION 101440 - SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Interior signage of the following types:
 - 1. Lucent, custom construction.

1.2 REFERENCES

- A. ICC/ANSI A117.1 - Accessible and Useable Buildings and Facilities.
- B. USATBCB - Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG).

1.3 SUBMITTALS

- A. Submit under provisions of Section 013300.
- B. Product Data: Manufacturer's descriptive literature.
- C. Shop Drawings: List sign styles, lettering, locations and dimensions of each interior sign. Contractor shall submit a sign schedule with doors listed in numerical order for review and approval. Shop drawings shall include a scaled diagram of each type of sign specified.
- D. Selection Samples: One complete set of color chips representing manufacturer's full range of available colors.
- E. Verification Samples: Two full size samples, representing type, style and color specified including method of attachment.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with requirements of ICC/ANSI A117.1 and ADAAG.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inspect products upon receipt. Store products in manufacturer's packaging until ready for installation.

1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Best Sign Systems, Inc.; 1202 N. Park Avenue, Montrose, CO 81401. ASD. TEL: (800) 235-BEST. FAX (970) 249-0223. Email: sales@bestsigns.com www.bestsigns.com.
- B. Requests for substitutions will be considered in accordance with provisions of Section 016000.

SECTION 101440 - SIGNAGE (continued)

2.2 SIGNS

- A. ADA-Compliant Interior Signage, Custom Design.

2.3 INTERIOR SIGNAGE

- A. Manufacturer's standard monolithic tactile plaque constructed utilizing a thermoforming process, which provides a fully homogeneous plaque sign. The sign body, face, raised text and Braille are compression molded to form a single dimensional component that results in a sign surface that exhibits a toughness that resists scratching, cracking, gouging and graffiti.
1. Style: Custom Lucent Sign by Best Sign Systems, Inc
 2. Material: Extruded Clear Acrylic
 3. Sign Thickness: 1/4 inch (6mm)
 4. Tactile Characters/Symbols: Raised 1/32 inch (1 mm) from sign plate face
 5. Construction: One-piece; added on or engraved characters not acceptable
 6. Lettering Style: Typeface as selected from the manufacturer's standard sans serif or simple serif typefaces, upper case letters, minimum height 5/8", maximum height 2"
 7. Braille: Grade 2 braille, placed directly below last line of letters or numbers
 8. Contrast: Letters, numbers and symbols shall contrast with background.
 9. Bevel Options: Bullnosed
 10. Profiles: 1/4" radiused
 11. Color of Background: Colors chosen from 73 Standard Paint colors, subsurface or surface applied
 12. Color of Text and Raised Characters: As selected from 73 standard colors
 13. Surface Texture: Stipple
 14. Signage shall be approved for use at interior doors as well as exterior doors.

2.4 ROOM SIGNAGE

- A. All doors (interior and exterior) shall receive a Type "A" sign. Provide a schedule with the room number and name as shown on the signage schedule for the architect and owner to review and edit.
- B. All restrooms shall receive a Type "B" sign. They are to be an ADA compliant regulatory sign with text, braille and universal symbol.
- C. Each room with an exterior, operable window to receive a sign that states 'ENSURE WINDOWS ARE LATCHED DURING A HURRICANE EVENT'. Sign to be posted adjacent to the window.

2.5 EXTERIOR SIGNS:

- A. Provide an interior mounted 'Design Information Sign' in the Building with the following information (see Figure 1):

- 1) HURRICANE SAFE AREA
- 2) CAPACITY: 40 OCCUPANTS
- 3) 200 MPH WIND SPEEDS (3 SECOND GUST)
- 4) DESIGNED TO ICC 500-2020 AND FEMA P-361-2021
- 5) BUILDER: _____.

- D. Provide (3) 7" x 10", 'Safe Room Direction Signs' in the existing north end of the Building's 'Hallway' and 2 on the west side exterior. The sign will show Black text & directional arrows on a White background and stating the following (see sheet A1.1, Demolition Plan location):

- 1) SAFE ROOM
- 2) *DIRECTIONAL ARROW POINTING TOWARD THE SAFE ROOM BUILDING ENTRY (1 LEFT ARROW; 2 RIGHT ARROWS)*

SECTION 101440 - SIGNAGE (continued)

- A. Provide an exterior mounted 'Safe Room Entry Sign' at each corridor entry of the newly Remodeled Building area showing/stating the following:
 - 1) HURRICANE SYMBOL/IMAGE
 - 2) HURRICANE SAFE ROOM
- B. Provide an interior mounted 'Safe Room Perimeter Sign' at each corridor exit of the Building showing/stating the following:
 - 1) NOTICE: NOW LEAVING THE HURRICANE SAFE ROOM

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine installation areas to ensure that conditions are suitable for installation.
- B. Examine signage for defects prior to installation. Do not install damaged signage.

3.2 PREPARATION

- A. Verify mounting heights and locations for interior signage will comply with referenced standards.
- B. Clean mounting locations of dirt, dust, grease or similar conditions that would prevent proper installation.

3.3 INSTALLATION

- A. Install signs level, plumb, without distortion, and in proper relationship with adjacent surfaces using manufacturer's recommended standard mounting system.
 - 1. Mount with vinyl foam tape.
- B. Remove adhesive from exposed sign surfaces as recommended by manufacturer.
- C. Clean signs after installation as recommended by manufacturer.
- D. Replace damaged products before Substantial Completion.

3.4 ADA GUIDELINES FOR SIGNAGE

- A. Room Identification Signs: Signs which designate permanent rooms or spaces shall comply with the following guidelines:
 - 1. Raised Copy - Letters and numerals shall be raised 1/32" upper case, sans serif or simple serif typestyle.
 - 2. Symbols - Symbols shall be accompanied by the equivalent verbal description placed directly below the symbol. The border dimension of the symbol shall be 6" minimum in height.
 - 3. Braille Tags - Grade 2 Braille shall be on all signs, as required.
 - 4. Colors - The characters and backgrounds of all signs shall be of matte or other non-glare finish. Characters and symbols shall contrast with light characters on a dark background or dark characters on a light background. Colors to be as selected by the Architect from the manufacturer's standard colors.

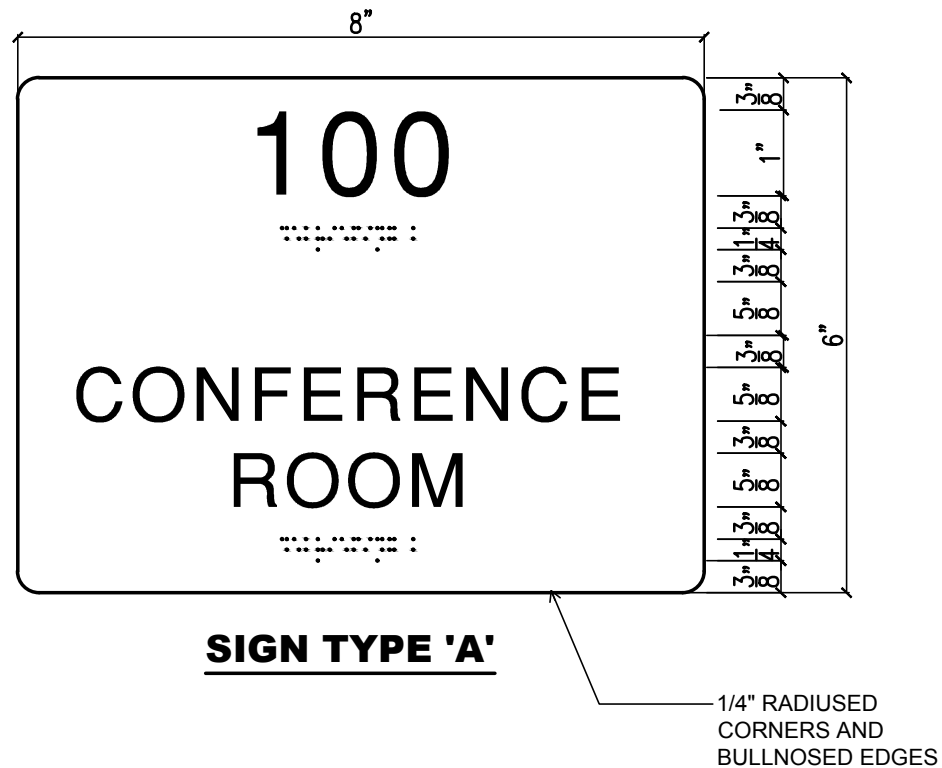
SECTION 101440 - SIGNAGE (continued)

- B. Directional and Information Signs: Signs which provide direction to, or information about, functional spaces of the building shall comply with the same guidelines as those set for Room Identification Signs with the following additions and exceptions.
1. Character Proportion - Letters and numerals on sign shall have a width to height ratio between 3:5 and 1:1 and a stroke width to height ratio between 1:5 and 1:10.
 2. Character Height - Characters and numbers on signs shall be sized according to the viewing distance from which they are to be read. The minimum height is measured using an upper case X. Lower case characters are permitted. Any signs that are suspended or projected overhead shall have characters at least three inches high and shall maintain a minimum clearance of 80 inches from finished floor.
 3. Raised Copy - Directional and Informational signs are NOT required to use raised copy or braille tags.
- C. Signage Mounting Location and Height: Where permanent identification is provided for rooms and spaces, signs shall be installed on the wall adjacent to the latch side of the door. Where there is no wall space to the latch side of the door, including at double leaf doors, signs shall be placed on the nearest adjacent wall. Mounting height shall be 60 inches (1525 mm) above the finish floor to the centerline of the sign. Mounting location for such signage shall be so that a person may approach within 3 inches (76 mm) of signage without encountering protruding objects or standing within the swing of a door.

Figure 1:



END OF SECTION 101440



Clemons, Rutherford
& Associates Inc.
2027 Thomasville Road
Tallahassee, Florida 32308
(850) 385-6153
Fax (850) 386-8420

SIGNAGE TYPES

PROJECT: CITY OF PANAMA CITY BEACH
PUBLIC WORKS BUILDING - SAFE ROOM
PANAMA CITY BEACH, FL

CRA PROJECT NO.: 23007

SECTION 102800 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUBMITTALS

- A. Product Data: For each type of product included. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Manufacturer=s warranty.
- B. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

- 1.03 STRUCTURAL REQUIREMENTS: All grab bars and their mounting devices shall withstand a downward load of at least 250 lbs. of force when tested according to method in ASTM F 446.

1.04 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within a 5-year period from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.01 MANUFACTURER: Provide toilet and bath accessories as manufactured by Bobrick OR approved equal.

- 2.02 GENERAL: Provide toilet and bath accessories as scheduled. Install units at locations and heights as indicated, plumb and level, firmly anchored, in accordance with manufacturer's instructions.

2.03 MATERIALS:

- A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 22 gage minimum, unless otherwise indicated.
- B. Mirror Glass: 1/4" thick, Type I, Class 1, Quality q2, conforming to FS DD-G-451, with silvering, copper coating, and protective organic coating complying with FS DD-M-411.
- C. Galvanized Steel Sheet: ASTM A 527, G60.
- D. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit or of galvanized steel where concealed.

- 2.04 GENERAL FABRICATION: Stamped names or labels on exposed faces of toilet and bath accessory units are not permitted, however unobtrusive labels indicating manufacturer and model number are required on surface not exposed to view. Wherever locks are required for particular type of accessory, provide same keying throughout project. Furnish two keys for each lock, properly identified.

SECTION 102800 - TOILET AND BATH ACCESSORIES (continued):

- B. Mirror Fabrication: Fabricate frames for glass mirrors to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system which will permit rigid, tamperproof glass installation and prevent accumulation of moisture.
- C. Surface-Mounted Accessories: Fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous piano hinge or minimum of two 1-1/2" pin hinges of same metal as unit cabinet. Provide concealed anchorage wherever possible.
- D. Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all welded construction, without mitered corners. Hang doors or access panels with full-length stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.

2.05 TOILET ACCESSORY ITEMS: Provide the following toilet accessories by Bobrick Washroom Equipment Inc. OR approved equal, unless otherwise noted.

- A. Grab Bars: Provide stainless steel grab bars with wall thickness not less than 18 gage, outside diameter 1-1/2", concealed mounting, with #4 polished satin finish. Refer to Drawings for configurations and size of grab bars. Provide concealed anchors for each flange as per manufacturer's recommendations. **(B-6806-36; B-6806-42).**
- B. Stainless Steel Framed Mirrors: Fabricate frame with angle shapes of not less than 18 gage (.050"), with square corners mitered to hairline joints and mechanically interlocked; tamper-resistant concealed wall hanger. Provide in No. 4 satin polished finish. **(B-165 1836 18" x 36")**
- C. Twin Jumbo Roll Tissue Dispenser: Dispenser door, cabinet and mounting plate shall be constructed of Type 304 stainless steel with satin finish; door shall be 18 gauge; cabinet and mounting plate shall be 20 gauge. Cabinet shall be equipped with tumbler lock. Door shall have a wide viewing slot to reveal toilet tissue supply. Dispensing mechanism shall be constructed of high-impact, chemical-resistant, flame-retardant rigid vinyl; shall accommodate two 10" diameter toilet tissue rolls; and be equipped with a sliding access panel that exposes one roll at a time. Spindles shall be convertible in the field to dispense 3" or 2¼" diameter core rolls with use of removable core-adapters furnished. **(B-2892)**
- D. Surface Mounted Toilet Tissue Dispenser for Two Rolls: Double-roll toilet tissue dispenser shall have a heavy-duty cast-aluminum bracket with satin finish. Bracket shall be equipped with a tumbler lock to secure spindles in place. Vandal-resistant spindles shall be molded high-impact ABS. Unit shall accommodate two standard-core toilet tissue rolls up to 6" diameter (2000 sheets). **(B-27460) Utilized in ADA toilet rooms & stalls**
- D. Surfaced Mounted Paper Towel Dispenser: Surface mounted paper towel dispenser shall be constructed of Type 304 stainless steel, welded construction. Exposed surfaces shall have satin finish. Door shall be equipped with full-length stainless-steel piano hinge and tumbler lock. Paper towel capacity: 400C or 525 multi-fold. **(B-262)**
- E. Surface Mounted Soap Dispenser (B-211):
 - 1. Specification: Surface-mounted soap dispenser shall be Type 304 stainless steel with satin-finish. Corrosion-resistant valve shall dispense commercially marketed all-purpose hand soaps, non-iodine based soaps and do not use alcohol based sanitizers. To prevent corrosion of tank, use only chloride-free pH-neutral liquid soaps. Valve shall be operable with one hand and with less than 5 pounds of force (22.2N) to comply with accessible design guidelines (including ADAAG in the U.S.A.). Container shall be equipped with a clear acrylic refill-indicator window; a locked, hinged stainless steel lid for top filling; and shall have a capacity of 40-fl oz (1.2L) . Unit shall have concealed, vandal-resistant mounting. Model: **(B-2111)**

SECTION 102800 - TOILET AND BATH ACCESSORIES (continued):

- F. Mop and Broom Holder/Utility Shelf: Combination unit with 18-gage (.050") Type 304 stainless steel shelf with 1/2" returns, 16-gage (.062") support brackets for wall mounting, provide 16-gage stainless steel hooks for wiping rags on front of shelf, together with spring-loaded rubber cam type mop/broom holders; 1/4" diameter stainless steel drying rod suspended beneath shelf. Provide 34" long unit with 3 mop/broom holders and 4 hooks. **(B-239 x 34)** Provide 44" long unit with 4 mop/broom holders and five hooks. **(B-239 x 44)**
- G. Double Robe Hook: Type 304 stainless steel with bright polished finish. Flange and support arm shall be 22 gauge with concealed mounting bracket. Cap shall be 14 gauge welded to support arm. **(B-7672)**
- H. Folding Utility Shelf: Utility shelf shall be Type 304 stainless steel with all-welded construction; exposed surfaces shall have satin finish. Shelf shall be equipped with a heavy-duty internal spring. Mounting bracket shall be Type 304 stainless steel with satin finish. Shelf shall automatically return to upright position when not in use. **(B-287)**

PART 3 - EXECUTION

3.01 INSTALLATION:

- a. Install toilet accessory units in accordance with manufacturer's instructions, using fasteners appropriate to substrate and recommended by manufacturer of unit. Install units plumb and level, firmly anchored in locations indicated and in accordance with the requirements of ADA.

3.02 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protection coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104416 - FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 - GENERAL

- 1.01 **UL-Listed Products:** Provide new UL-listed fire extinguishers bearing UL "Listing Mark" for type, rating, and classification of extinguishers indicated.
- 1.02 **Submittals:** Submit product data and finish samples.

PART 2 - PRODUCTS

- 2.01 **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
- | | |
|--|---------------------------------------|
| Allenco | Larsen's Manufacturing Co |
| Ansul Fire Protection, Wormald US Inc. | Modern Metal Products by Muckle |
| Badger-Powhatan | Potter-Roemer, Inc. |
| Bobrick Washroom Equipment, Inc. | Walter Kidde, Division of Kidde, Inc. |
| J.L. Industries | |
- 2.02 **Fire Extinguishers:** Provide fire extinguishers for each extinguisher cabinet and other locations indicated on Life Safety Plans.
- A. **Contractor's Option:** Contractor has option to provide rated fire extinguisher cabinets in rated walls OR provide 5-sided gypsum board box in rated walls.
- 2.03 **Multipurpose Dry Chemical Type:**
- A. **Typical Areas:** UL-rated 3A-20 B: C min., in enameled steel containers.
- B. **Labs, Shops, Boiler Rooms, Bulk Storage, Electrical and Equipment Rooms:** UL-rated 3A-40 B: C min., in enameled steel containers.
- C. **Bulk Paper Storage:** UL-rated 4A-60 B:C, in enameled steel containers.
- D. **Kitchens:** UL-rated 3A-40 B:C min.
- 2.04 **Mounting Brackets:** Provide brackets for extinguishers not located in cabinets.
- 2.05 **Fire Extinguisher Cabinets:** Provide fire extinguisher cabinets where indicated, of suitable size for housing fire extinguishers of types and capacities indicated.
- A. **Semi-Recessed:** Cabinet box (tub) recessed in walls of sufficient depth to suit style of trim indicated,
1. **Exposed Trim:** One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - a. **Rolled Edge Trim** with 2-1/2 inch backbend depth.
 - b. **Trim Metal:** Of same metal and finish as door.
 2. **Locations:** Corridors; must not be more than 4".
- B. **Surface Mounted:** Cabinet box fully exposed and mounted directly on wall; with no trim.
- 2.06 **Door Material and Construction:** Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.
- A. **Enameled Steel:** Manufacturer's standard finish, hollow steel door construction with tubular stiles and rails.

SECTION 104416 - FIRE EXTINGUISHERS, CABINETS AND ACCESSORIES (continued):

- B. Identify fire extinguisher in cabinet with lettering spelling "FIRE EXTINGUISHER" applied by silkscreen method to door. Provide lettering to comply with requirements indicated for letter style, color, size, spacing, and location or as selected by Architect from manufacturer's standard arrangements. Lettering shall be vertical and red. Cabinet shall be white.
 - C. Door Style: Manufacturer's standard full flush solid panel of material indicated.
 - D. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam action latch, or door pull, exposed or concealed, and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 deg.
- 2.07 Factory Finishing of Fire Extinguisher Cabinet: Comply with NAAMM "Metal Finishes Manual" to provide uniformly finished products. Protect mechanical finishes on exposed surfaces from damage by application of strippable, temporary protective covering prior to shipment. Cabinet shall be mounted 48" A.F.F. to center of cabinet handle.
- 2.08 Fire Blanket and Cabinet: Provide fire blanket and surface mounted cabinet "FB 1016" by Larsen's Manufacturing Company OR approved equal. Each cabinet shall be constructed of cold-rolled steel with a red baked acrylic enamel finish. Each cabinet shall have a 62" x 80" fire blanket made of a rugged blend of reprocessed wool. Cabinet shall be mounted 48" A.F.F. to center of cabinet handle.

PART 3 - EXECUTION

- 3.01 Installation:
- A. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.
 - B. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.
 - C. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.

END OF SECTION 104416

SECTION 105113 - HEAVY-DUTY STEEL LOCKERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Heavy-duty steel lockers.

1.02 RELATED SECTIONS

- A. Division 3 – Cast-in-Place Concrete
- B. Division 9 – Resilient Base.

1.03 REFERENCES

- A. ASTM A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. ASTM A 1008 – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

1.04 SUBMITTALS

- A. Comply with Division 1 – Submittal Procedures.
- B. Product Data: Submit manufacturer's product data and installation instructions.
- B. Shop Drawings: Submit manufacturer's shop drawings, indicating construction, materials, dimensions, door frames, doors, handles, ventilation, options, accessories, locker benches, finish, locker layout, anchoring, and installation details.
- C. Samples: Submit manufacturer's standard colors on a card stock sheet. Allow architect to order actual metal samples of up to 6 colors for final selection.
- E. Warranty: Submit manufacturer's standard warranty.

1.05 QUALITY ASSURANCE

- A. Pre-installation Meeting: Convene pre-installation meeting before start of installation of lockers. Require attendance of parties directly affecting work of this section, including Contractor, Architect and installer, and Review installation, adjusting, cleaning, protection, and coordination with other work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
- C. Handling: Protect materials and finish during handling and installation to prevent damage.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Lyon LLC, PO Box 671, Aurora, Illinois 60507. Toll Free (800) 323-0082. Phone (630) 892-8941. Fax (800) 367-6681. Web Site www.lyonworkspace.com. E-Mail lyon@lyonworkspace.com OR Approved Equal.

SECTION 105113 - HEAVY-DUTY STEEL LOCKERS (Continued):

2.02 HEAVY-DUTY STEEL LOCKERS

- A. Model: Heavy-Duty Quiet Lockers.
- B. Style: Single tier.
- B. Locker Size: (See Architectural drawings for locations.)
 - 1. 15 inches wide by 15 inches deep by 72 inches high per opening (single tier)
- D. Locker Configuration: As indicated on the Drawings.
- E. Construction: All welded. Pre-assembled, with seams and joints welded.
- F. Material:
 - 1. Steel: ASTM A 653, galvanized steel.
 - 2. Bolts: Zinc plated or other comparable rust-retardant treatment.
- G. Body:
 - 1. 16-gauge steel.
 - 2. Flanged to give double thickness of metal at seams, joints, and corners.
 - 3. Back: 18-gauge steel.
- H. Door Frame:
 - 1. 16-gauge formed-steel channels.
 - 2. Vertical Members: Additional flange to form continuous door strike.
 - 3. Corners: Lapped and welded into rigid assembly.
 - 4. Bottom Cross Members: Tang at each end that fits through slot in rear flange of upright frame member to prevent twisting out of alignment.
 - 5. Top and Bottom Cross Members: Provide support for front edge of locker top and bottom.
- I. Doors:
 - 1. 1-piece, 14-gauge steel.
 - 2. Single, Double, and Triple-Tier Locker Doors: Both vertical edges formed into channel-shaped formation. Top and bottom flanged at 90-degree angle.
 - 3. Multiple-Tier Locker Doors: Hinge side formed into channel-shaped formation with other 3 sides flanged at 90-degree angle.
- J. Ventilation:
 - 1. Single Tier Lockers: Six, 6 inch louvers top and bottom.
- K. Hinges:
 - 1. Height: Minimum of 2 inches.
 - 2. Type: 0.050-inch thick steel, 5-knuckle, full-loop hinge forming double thickness on each leaf.
 - 3. Attachment: Set hinges in slot in door and frame and projection welded to frame and securely attached to door.
 - 4. Hinge Pin: Spun over at ends to resist removal.
 - 5. Single Tiers: 3 hinges.
 - 6. Mounting: Right-hand side of door.
- L. Multi-Point Locking Device:
 - 1. Double-Tier Locking Device: Engage frame at 3 points.
 - 2. Channel-Shaped Locking Device:
 - a. Full-length reinforcing ribs.
 - b. Quiet design using nylon-guide inserts to reduce metal-to-metal contact.
 - 3. Lock Bar: Enclosed on 3 sides and operate within channel formation of door.
 - 4. Locking Device: Prelocking so mechanism can be locked in open position. Door locking automatically when closed.
 - 5. Door Jambs:
 - a. Single-Tier Lockers: 3 jambs welded to side of door frames to engage locking device.
 - b. Safety Reverse Nose for Each Jamb: Eliminate hazard of sharp-pointed edges protruding into locker.

SECTION 105113 - HEAVY-DUTY STEEL LOCKERS (Continued):

- c. Easily replaceable soft rubber bumper for each jamb.
- 6. Multiple-Tier Lockers: 14-gauge steel lock clip for attaching padlock.
- 7. Doors: Provided with lock hole filler to permit use of built-in key or combination lock.

M. Handles:

- 1. Tamper-Guard Handles:
 - a. Single, double, and triple-tier lockers.
 - b. Chrome-plated, die-cast zinc alloy, with minimum tensile strength of 40,000 psi.
 - c. No moving parts shall operate against outside surface of locker.
 - d. Padlock Attachment: Integral part of lift, attached directly to locking bar and protected by fixed-handle housing.
 - e. Built-in padlock strike.
- 2. Door Pulls:
 - a. Multiple-tier lockers.
 - b. 16-gauge steel door pull with padlock attachment, when not used with built-in locks.
 - c. Roll-point catch.

O. Coat Hooks:

- 1. Single-tier lockers.
- 2. 1 double-prong ceiling hook and 3 single-prong wall hooks.
- 3. Steel rod stock with ball points for snag-free use.
- 4. Attachment: 2 bolts.
- 5. Finish: Zinc-plated or comparable rust-retardant treatment.

2.03 ACCESSORIES

A. Number Plates:

- 1. Aluminum.
- 2. Size: 2-3/4 inches wide by 1 inch high.
- 3. Numbers: Clearly etched numbers a minimum of 3/8 inch high.
- 4. Attachment: Attach in prepunched holes near top of doors.

B. Tops: Continuous-sloping hoods.

C. Bottoms: Painted galvanized steel, 16 gauge.

D. Bases: Z-type, 14-gauge steel, 4 inches high, for no-leg lockers.

E. Floor Anchoring: Anchor lockers to floor in accordance with manufacturer's instructions.

F. Closures and Fillers:

- 1. Top closures, closure strips, front expansion fillers, and corner fillers.
- 2. Fill spaces between 2 lockers or between lockers and walls as required for proper fit.

G. End Panels:

- 1. End Cover Panels: 14-gauge steel, construction bolt heads exposed at perimeter.
- 2. End Finishing Panels: 16-gauge steel, no bolt heads exposed.

2.05 FINISH

A. General: Factory apply finish in accordance with manufacturer's instructions.

B. Standard Finish: Exposed steel parts shall be thoroughly cleaned, given bonding and rust-inhibitive phosphate treatment, and electrostatically sprayed with powder coat. Baked-on finish.

C. Antimicrobial Finish: Apply antimicrobial finish.

D. Color:

- 1. Exterior Color: To be selected by Architect from manufacturer's standard color selections.
- 2. Interior Color: Match exterior color.

SECTION 105113 - HEAVY-DUTY STEEL LOCKERS (Continued):

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive lockers. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

- A. Install lockers in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Install lockers plumb, level, square, rigid, with flush installation.
- C. Use manufacturer's supplied hardware.
- D. Anchoring: Anchor lockers to floors and walls as indicated on the Drawings.
- E. Sloping Hoods and Metal Fillers: Install sloping hoods and metal fillers using concealed fasteners.
- F. Joints: Provide flush hairline joints against adjacent surfaces.
- G. Number Plates: Attach number plates to face of doors level with 2 aluminum rivets. Attach in sequence as indicated on the Drawings.
- H. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- I. Remove and replace defective or damaged components that cannot be successfully repaired as determined by Architect.

3.03 ADJUSTING

- A. Adjust doors, locks, and operating hardware to function properly and for smooth operation without binding.

3.04 CLEANING

- A. Clean surfaces promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage finish.

3.05 PROTECTION

- A. Protect installed lockers from damage during construction.

END OF SECTION 105113

SECTION 220100 - GENERAL PROVISIONS FOR PLUMBING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Provisions of this Section apply to all Division 22 Specification Sections.

1.02 SUMMARY

- A. Section includes basic requirements for plumbing systems.

1.03 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. Furnish: Supply and deliver to project site, ready for subsequent requirements.
- C. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.
- D. Provide: Furnish and install, complete and ready for intended use.
- E. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- F. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.
- G. Concealed Work: Work hidden from view, including inside chases, furred spaces, **above ceilings**.
- H. Exposed Work: Work open to view, including inside mechanical and equipment rooms.

1.04 QUALITY ASSURANCE

- A. General:
 - 1. It is the intent of the plans and specifications to obtain a complete, operable and satisfactory installation.
 - 2. All materials shall be new, be properly labeled and/or identified and be in full compliance with the contract documents.
 - 3. All work shall comply with applicable Codes and Standards.

SECTION 220100 - GENERAL PROVISIONS FOR PLUMBING (continued):

- 4. Manufacturer's model names and numbers used in these specifications are subject to change per manufacturer's action. Contractor shall therefore verify them with manufacturer's representative before ordering any product or equipment
- B. Furnish new and unused materials and equipment manufactured in the U.S.A. Where two or more units of the same type or class of equipment are required provide units of a single manufacturer.

1.05 CODES AND STANDARDS

- A. Perform work in accordance with the following codes and any applicable statutes, ordinances, codes, and regulations of governmental authorities having jurisdiction.
 - 1. ASHRAE
 - a. Standard 90.1 Energy Standard for Buildings Except Low Rise Residential Buildings
 - 2. Occupational Safety and Health Regulations (OSHA).
 - 3. National Fire Codes
 - a. NFPA 1 Uniform Fire Code – 2021 (Florida Edition)
 - b. NFPA 70 National Electrical Code – 2020
 - c. NFPA 101 Life Safety Code – 2021 (Florida Edition)
 - 4. Florida Building Code, 2023 Edition
 - a. Building Code
 - b. Existing Building Code
 - c. Energy Conservation Code
 - d. Mechanical Code
 - e. Plumbing Code
 - f. Fuel Gas Code
 - g. Accessibility Code
 - 5. 2023 ICC 500 (FEMA 361 5th Edition)
 - a. Chapter 1 Application And Administration
 - b. Chapter 6 Fire Safety
 - c. Chapter 7 Essential Features And Accessories
 - d. Chapter 8 Test Methods For Impact And Pressure Testing
 - 6. Florida Statutes
 - a. Chapter 471 Engineering
 - b. Chapter 533.80 Building Construction Standards; Florida Building Code - Enforcement
 - 7. Florida Administrative Code
 - a. Chapter 61G15-34 Responsibility Rules of Professional Engineers Concerning the Design of Mechanical Systems
 - b. Chapter 69A-3 Fire Prevention – General Provisions
 - c. Chapter 69A-60 The Florida Fire Prevention Code
- B. Resolve, in writing, any code violation discovered in contract documents with the Engineer prior to bidding. After award of the contract, make any correction or addition necessary for compliance with applicable codes at no additional cost to Owner.

SECTION 220100 - GENERAL PROVISIONS FOR PLUMBING (continued):

- C. The Contractor shall include in the Work, without extra cost to the Owner, any labor, materials, services, apparatus, and drawings required to comply with all applicable laws, ordinances, rules, and regulations.
- D. Where there is conflict between the Contract Documents and the applicable Codes, the Codes shall govern, except where the requirements of the Contract Documents are more stringent.

1.06 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments, or supplements in effect on date bids are received. Specifications and standards are minimum requirements for all equipment, material and work. In instances where capacities, size or other feature of equipment, devices or materials exceed these minimums, meet listed or shown capacities.
- B. Whenever a reference is made to a standard, installation and materials shall comply with the latest published edition of the standard at the time project is bid unless otherwise specified herein

1.07 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.

1.08 PERMITS FEES AND INSPECTIONS

- A. Obtain and pay for all permits, fees, tap fees, connection charges, demand charges, systems charges, impact fees, and inspections.
- B. Deliver all certificates of inspection issued by authorities having jurisdiction to the Engineer.

1.09 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for direction before proceeding.
 - 1. If discrepancies or conflicts occur between drawings, or between drawings and specifications, notify the Engineer in writing prior to bid date; however, the most stringent requirement shall govern.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.10 SUBMITTALS

SECTION 220100 - GENERAL PROVISIONS FOR PLUMBING (continued):

- A. Submittals (including Product Data, Shop Drawings, and any other Action Submittal or Information Submittal) will only be reviewed if they are submitted in full accordance with the General and Supplementary Conditions, Division 01, and the following:
1. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are approved by the Engineer.
 3. Submittals shall only contain relevant product data. Remove or strikeout irrelevant product data.
 4. Prepare submittals as PDF electronic files and electronically transmit to Engineer through email or web-based project software site, in accordance with Division 01 Specification Sections. Submittals shall be in searchable PDF format and not a scanned copy.
 5. Options: Identify options requiring selection by Engineer.
 6. Deviations: Clearly identify deviations from requirements in the Contract Documents, including minor variations and limitations.
 7. Revisions: Include relevant additional information and revisions, other than those specifically requested by Engineer on previous submittals. Indicate by highlighting on each submittal or noting on attached submittal sheet.
 8. Contractor's Review:
 - a. Submittals shall have been reviewed and approved by the General Contractor / Construction Manager. Include approval stamp, 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.
 - b. Engineer will not review submittals received from Contractor that do not have Contractor's review and approval.
 9. Electrical Modifications:
 - a. The electrical design indicated on the plans supports the Basis of Design specifications for the Plumbing systems at the time of design.
 - b. If Plumbing equipment is submitted with different electrical requirements, it is the responsibility of the Contractor to resolve all required electrical design changes, including, but not limited to: wire and conduit size, type or size of disconnect or overload protection, breaker coordination, point(s) of connection, etc. Any corrections required shall be provided at no additional cost.
 - c. Submittal shall clearly show the electrical design revisions with a written statement that this change will be provided at no additional cost. Submittals made with no written reference to the electrical design revisions will be presumed to work with the electrical design.
- B. Processing Time: Allow 15 days for submittal review. Time of review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of the failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. The Contractor shall not be relieved of responsibility for deviations from requirements of the contract documents by the Engineer's approval of shop drawings, product data, samples, or similar submittals unless the Contractor has specifically informed the Engineer in writing of such deviation at the time of submittal, and the Engineer has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in shop drawings, product data, samples, or similar submittals by the Engineer's approval thereof.

SECTION 220100 - GENERAL PROVISIONS FOR PLUMBING (continued):

- D. Submittals on any particular phase of Work will receive only one review and one re-review (if required). If additional reviews are required beyond these two, the Contractor will be charged \$120.00 per hour for review time. This fee shall be paid to the Engineer prior to Submittal release.

1.11 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
 - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, fire protection, mechanical, electrical, and communication systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, pull boxes, junction boxes, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 - 1. Floor Plans: Show architectural and structural elements, and Work associated with Divisions 21 through 29, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved. Supplement plan drawings with section drawings where required to adequately represent the Work.
 - a. Mechanical Systems (Divisions 21, 22, 23, 25):
 - 1) Sizes and bottom elevations of ductwork and piping runs, including insulation, heat tracing, bracing, flanges, and support systems. Indicate proposed changes to layout.
 - 2) Locations and sizes of major equipment and components.
 - 3) Fire-rated enclosures around ductwork.
 - 4) Structural members to which ductwork and piping will be attached or suspended from.
 - b. Electrical and Communication Systems (Divisions 25, 26, 27, 28, 29):
 - 1) Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.

SECTION 220100 - GENERAL PROVISIONS FOR PLUMBING (continued):

- 2) Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - 3) Panel board, switch board, switchgear, transformer, busway, generator, and motor-control center locations.
 - 4) Location of pull boxes and junction boxes, dimensioned from column center lines.
 - 5) Structural members to which luminaire and equipment will be attached or suspended from.
 - 6) Lightning protection system components attaching to or penetrating through the roofing and moisture protection systems, coordinated with the roofing system manufacturer.
 - 7) Cable tray layout, offsets, transitions, clearances, elevations, and relationships between components and adjacent structural, mechanical and electrical elements.
 2. Reflected Ceiling Plans: Show locations of visible devices mounted to, suspended from, or penetrating through the ceiling, relative to the finished ceiling, including the following:
 - a. Fire suppression sprinklers and nozzles.
 - b. Air outlets and inlets.
 - c. Luminaires (Lighting fixtures).
 - d. Lighting control devices.
 - e. Speakers.
 - f. Ceiling-mounted projectors.
 - g. Access control devices.
 - h. Video surveillance devices.
 - i. Fire alarm devices.
 - j. Access panels.
 - k. Perimeter moldings.
 - l. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the ceiling.
 3. Plenum Space: Indicate subframing for support of ceiling and wall systems, equipment for Divisions 21 through 29, and related Work. Locate components within plenums to accommodate layout of components indicated on Drawings for Divisions 21 through 29. Indicate areas of conflict between components of Divisions 21 through 29.
 4. Equipment Rooms: Provide coordination drawings for equipment rooms showing plans and elevations of equipment for Divisions 21 through 29.
 5. Penetrations: Indicate locations of penetrations and openings in structural components, smoke barriers, and fire-rated construction.
 6. Review: Engineer will review coordination drawings to confirm that in general the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Engineer determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Engineer will so inform Contractor, who shall make suitable modifications and resubmit.
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Submittal Format: Submit or post coordination drawing files using PDF format.
 2. BIM File Incorporation: Develop and incorporate coordination drawing files into BIM established for Project.
 - a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Engineer.

SECTION 220100 - GENERAL PROVISIONS FOR PLUMBING (continued):

3. Engineer will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
 - a. Engineer makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Engineer.

1.12 SUBSTITUTIONS

- A. By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.
- B. Substitution Requests shall include, at a minimum:
 1. Statement indicating why specified material, equipment, or installation method cannot be provided, if applicable.
 2. Coordination of information, including a list of changes and 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.
 3. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include an 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.
 4. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 5. 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.
 6. Cost information, including a proposal of change, if any, in the Contract Sum.
 7. 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.
 8. 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.
- C. Procurement Substitution Requests submitted prior to receipt of bids will be received and considered by Owner when the following conditions are satisfied, as determined by Engineer; otherwise, requests will be returned without action:
 1. Requests for substitution of materials and equipment are received no later than 10 days prior to date of bid opening.
 2. Extensive revisions to the Contract Documents are not required.
 3. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.
 4. The request is fully documented and properly submitted.
- D. Substitutions for Cause, as required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms will be received and considered by

SECTION 220100 - GENERAL PROVISIONS FOR PLUMBING (continued):

Engineer, only when the following conditions are satisfied; otherwise, requests will be returned without action, except to record noncompliance with these requirements:

1. Requested substitution is consistent with the Contract Documents and will produce indicated results.
2. Substitution request is fully documented and properly submitted.
3. Requested substitution has received necessary approvals of authorities having jurisdiction.
4. Requested substitution is compatible with other portions of the Work.
5. Requested substitution has been coordinated with other portions of the Work.
6. Requested substitution provides specified warranty.
7. 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.

E. Substitutions for Convenience, not required in order to meet other Project requirements but may offer advantage to Contractor or Owner, will be received and considered by Owner, as determined by Engineer, only when the following conditions are satisfied; otherwise, requests will be returned without action, except to record noncompliance with these requirements:

1. Requested substitution is received within 60 days after the Notice of Award.
2. 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 Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
3. Requested substitution does not require extensive revisions to the Contract Documents.
4. Requested substitution is consistent with the Contract Documents and will produce indicated results.
5. Substitution request is fully documented and properly submitted.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. 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.

F. If a requested substitution is approved but contains differences or omissions not specifically identified to the attention of the Engineer in the substitution request, the Owner reserves the right to require equal or similar features to be added to the substituted products or to have the substituted products replaced at the Contractor's expense.

1.13 PROJECT RECORD DOCUMENTS

A. Recording: Maintain one copy of the Contract Documents and Shop Drawings during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Preparation:

1. Contract Drawings and Shop Drawings:
 - a. Mark revisions to show where the actual installation varies from that shown originally.
 - b. Mark record sets completely and accurately, including important information that was either shown schematically or omitted from original Drawings.

SECTION 220100 - GENERAL PROVISIONS FOR PLUMBING (continued):

- c. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - d. Record underground and under-slab piping installed, dimensioning exact location and elevation of piping.
 - 2. Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 3. Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
- C. Deliver: Prior to Final Completion, provide record documents to Owner as indicated below:
- 1. Record Drawings: Submit PDF electronic files of scanned record prints and one set of prints.
 - 2. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
 - 3. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
 - 4. Miscellaneous Record Submittals: Submit annotated PDF electronic files directories of each submittal.

1.14 OPERATION AND MAINTENANCE MANUALS

- A. Prepare and submit a comprehensive manual of emergency, operation, and maintenance data and materials in full accordance with the General and Supplementary Conditions, Division 01, and the following:
- 1. Operations and Maintenance Manuals: Assemble a complete set of data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system, including:
 - a. Information required for daily operation and management, operating standards, and routine and special operating procedures.
 - b. Manufacturers' maintenance documentation, preventative maintenance procedures and frequency, repair procedures, wiring and systems diagrams, list of spare parts, and warranty information.
 - 2. Submit manuals as PDF electronic files and electronically transmit to Engineer through email or web-based project software site, in accordance with Division 01 Specification Sections. Submittals shall be in searchable PDF format and not a scanned copy.

1.15 DEMONSTRATION AND TRAINING

- A. Prepare and provide services of qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not a part of a system in accordance with the General and Supplementary Conditions, Division 01, individual Specification Sections, and the following:
- 1. Demonstration and training shall occur upon completion of the Work and at a time designated by the Owner's representative.
 - 2. Provide a high-resolution, digital video recording of each training session to the Owner.

1.16 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.

SECTION 220100 - GENERAL PROVISIONS FOR PLUMBING (continued):

- B. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

1.17 WARRANTY

- A. Warranty work and equipment within specified warranty period. During the warranty period, provide labor and materials to make good any faults or imperfections that may arise due to defects or omissions in materials or workmanship without expense to the Owner.
 - 1. Warranty Period: One year from date of Substantial Completion.
- B. 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 Contract Documents.
- C. Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond nor relieving the Contractor of responsibilities during the warranty period.

PART 2 - PRODUCTS (NONE)

PART 3 - EXECUTION

3.01 CONTRACT DOCUMENTS

- A. Examine all drawings and specifications carefully before submitting a bid. **Architectural drawings take precedence over mechanical or electrical drawings with reference to building construction.**
- B. For purposes of clearness and legibility, drawings are essentially diagrammatic and, although size and location of equipment are drawn to scale wherever possible, Contractor shall make use of all data in all of the contract documents and shall verify this information at the building site.
- C. The drawings indicate required size and points of termination of pipes, conduits, and ducts and suggest proper routes to conform to structure avoid obstructions and preserve clearances. However, it is not intended that drawings indicate all necessary offsets, and it shall be the responsibility of the Contractor to make the installation in such a manner as to conform to structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further instructions or cost to the Owner.
- D. Furnish, install and/or connect with appropriate services all items shown on any drawing without additional compensation.
- E. Any and all questions about a subcontractor's scope of work responsibility shall be addressed to and answered by the General Contractor / Construction Manager.
- F. Questions About Construction Documents: Any and all questions shall be submitted through the proper channels IN WRITING and, in turn, shall be answered by the Engineer in writing. All telephone conversations shall be considered unofficial and, as such, shall not be considered official or binding responses to Contractor's questions.
- G. Drawings, specifications, or other documents issued by the Engineer in electronic format and/or electronic media are provided for convenience only and are not intended for use as Contract Documents.

SECTION 220100 - GENERAL PROVISIONS FOR PLUMBING (continued):

1. The electronic files are provided merely as a convenience to the Recipient.
2. The electronic files do not replace or supplement the paper copies of any drawings, specifications, or other documents included in the Contract Documents for use on the project.
3. The Engineer makes no representation, warranty, or guarantee that electronic files:
 - a. Are suitable for any other usage or purpose.
 - b. Have any particular durability.
 - c. Will not damage or impair the Recipient's computer or software.
 - d. Contain no errors or mechanical flaws or other discrepancies that may render them unsuitable for the purpose intended by the Recipient.
4. Due to the unsecured nature of the electronic files and the inability of Engineer or the Recipient to establish controls over their use, the Engineer assumes no responsibility for any consequences arising out of the use of the data. It is the sole responsibility of the Recipient to check the validity of all information contained therein. The Recipient shall at all times refer to the signed and sealed drawings, specification or other documents for the project during all phases of the project. The Recipient shall assume all risks and liabilities resulting from the use of the electronic files.

3.02 SUPERVISION OF WORK

- A. Perform all work under the direct supervision of an experienced, qualified superintendent. The Engineer has the right to remove a superintendent who, in the Engineer's opinion, is not satisfactory.

3.03 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, mechanical and electrical systems, and other construction affecting the Work.
- 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.
 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. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.04 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, 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

SECTION 220100 - GENERAL PROVISIONS FOR PLUMBING (continued):

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 caused by differing field conditions outside the control of Contractor, submit a request for information to Engineer.
- E. Interruption of Service: Before any existing equipment or system is shut down for disconnecting or tie-ins, coordinate with Engineer and Owner regarding acceptable dates and times for this Work to be performed. Work shall be performed at the time best suited for the Owner, which typically is either on weekends, holidays, and/or after normal working hours. Services shall be restored the same day unless prior arrangements are made. All overtime or premium costs associated with this Work shall be included in the Contractor's bid.

3.05 INSTALLATION

- A. Install materials and equipment in a professional manner. The Engineer may direct replacement of items which, in the Engineer's opinion, do not present a professional appearance or do not allow adequate space for maintenance. Replace or reinstall items at the expense of the Contractor.
- B. General: 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 (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.
- C. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- D. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- E. 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.
- F. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- G. Obstructions
 - 1. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
 - 2. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided. Verify locations given.

SECTION 220100 - GENERAL PROVISIONS FOR PLUMBING (continued):

3. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
 4. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.
- H. Where "rated" walls, floor, roofs and ceilings are penetrated or cut to install equipment, materials, devices, etc. the Contractor shall provide and install all materials required to re-establish the rating of the wall, floor, roof, or ceiling to the satisfaction of the authority having jurisdiction.
- I. Structural Elements: Do not cut structural elements without written approval from Engineer. Notify Engineer of locations and details of cutting and await directions from Engineer before proceeding. If approved by Engineer:
1. Shore, brace, and support structural elements during cutting and patching.
 2. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
- J. Space Requirements: Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material which is not suitable in this respect.
- K. Tools and Equipment: Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions without cost to the Owner.
- L. Phasing: Provide all temporary valves, piping, ductwork, equipment, and devices as required. Maintain temporary services to areas as required. Remove all temporary material and equipment on completion of work unless Engineer concurs that such material and equipment would be beneficial to the Owner on a permanent basis.

3.06 OWNER-INSTALLED PRODUCTS

- A. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

3.07 PROTECTION OF EXISTING FINISHES, CARPET, AND FURNISHING

- A. Protect existing finishes, carpet, casework, furnishing, and other building components against damage and soiling throughout construction activities. Take care during construction not to damage existing items. Contractor shall be responsible for replacing damaged material or restoring damaged materials to the Owner's satisfaction.
- B. When permitted by Engineer, items may be removed to a suitable, protected storage location during construction and cleaned and reinstalled in their original locations after construction operations are complete.
- C. Furniture may be relocated during construction and reinstalled in their original locations after construction operations are complete.
- D. Means and methods for protection are the responsibility of the Contractor. Utilize plywood, polyethylene sheeting, dust cloths, and other means as required.

SECTION 220100 - GENERAL PROVISIONS FOR PLUMBING (continued):

3.08 UTILITY SERVICES AND PLUMBING SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and plumbing systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. Arrange to shut off utilities with utility companies.
 - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 4. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

3.09 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Structural Elements: When cutting and patching structural elements, notify Engineer of locations and details of cutting and await directions from Engineer before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
- F. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

SECTION 220100 - GENERAL PROVISIONS FOR PLUMBING (continued):

- G. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety.
- H. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- I. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- J. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable or with in-place materials.
 - 1. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 2. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials.
- K. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.10 PAINING

- A. Comply with requirements with General and Supplementary Conditions, Division 01, Division 09, and individual Specification Sections.
- B. Touch-up factory finishes on equipment provided under Division 21. Obtain matched color coatings from the manufacturer and apply as directed. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint, as required.
- C. Paint the following work where exposed to view:
 - 1. Uninsulated Metal Piping (bare copper piping not required to be painted unless noted otherwise):

SECTION 220100 - GENERAL PROVISIONS FOR PLUMBING (continued):

- a. Natural or LP Gas: Yellow
 - b. Other: To be determined by Engineer
- 2. Uninsulated plastic piping
- 3. Tanks that do not have factory-applied final finishes.
- 4. Equipment, and pipe insulation having a cotton or canvas insulation covering or other paintable jacket material, as outlined in individual Specification Sections.
- D. Paint the following work where exposed in occupied spaces:
 - 1. Equipment and pipe insulation having a cotton or canvas insulation covering or other paintable jacket material, as outlined in individual Specification Sections.
 - 2. Other items as directed by Engineer.
- E. Paint the following work where concealed from and/or exposed to view:
 - 1. Reuse or Reclaimed Water Supply: Purple

3.11 REPAIR OF WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 2. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

3.12 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Furnish a letter from the control manufacturer stating that all controls have been checked for operation and calibration, and the system is operating as designed.
- C. Furnish a letter from an authorized factory representative of the air conditioning unit manufacturer stating that the complete refrigeration installation including pipe sizing and routing and operating and safety controls has been checked and is operating properly.
- D. Tests

SECTION 220100 - GENERAL PROVISIONS FOR PLUMBING (continued):

1. Include all tests specified and/or required under laws, rules and regulations of all departments having jurisdiction. Tests shall also be performed as indicated herein and other sections of the specifications.
 2. After all systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation. Make adjustments as required to ensure proper functioning of all systems.
 3. All parts of the work and associated equipment shall be tested and adjusted to work properly and be left in perfect operating condition.
 4. Correct defects disclosed by these tests without any additional cost to the Owner. Repeat tests on repaired or replaced work.
 5. Maintain a log of all tests being conducted and have it available for review by the Engineer. Log to indicate date, type of tests, duration, and defects noted and when corrected.
 6. Special tests on individual systems are specified under individual Specification Sections.
- E. 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.

3.13 CLEANING

- A. Progress Cleaning: 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 (27 deg C).
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Final 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. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - b. Remove labels that are not permanent.
 - c. Wipe surfaces of equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

3.14 MAINTENANCE SERVICE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of systems and equipment Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

END OF SECTION 220100

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SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.

1.03 ACTION SUBMITTALS

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

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.01 SLEEVES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, with plain ends.
- B. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

2.02 STACK-SLEEVE FITTINGS

- A. Description: Manufactured, cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING (continued):

2.03 SLEEVE-SEAL SYSTEMS

A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:

1. **Advance Products & Systems, Inc.**
2. **Metraflex Company (The).**
3. Pipeline Seal and Insulator, Inc.

B. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of **20 psig (137 kPa)** minimum.
3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Composite plastic.
5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.04 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

B. Plastic or rubber waterstop collar with center opening to match piping OD.

2.05 GROUT

A. Description: Non-shrinking, for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: **5000-psi (34.5-MPa)**, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.06 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, non-sag, plus 25 percent and minus 25 percent movement capability, non-traffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. **Sealant shall have a VOC** content of 250 g/L or less.

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and non-traffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

1. **Sealant shall have a VOC** content of 250 g/L or less.

C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING (continued):

1. Sealant shall have a VOC content of 250 g/L or less.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide **1-inch (25-mm)** annular clear space between piping and concrete slabs and walls.
 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas **2 inches (50 mm)** above finished floor level.
 2. Using grout or silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 1. Cut sleeves to length for mounting flush with both surfaces.
 2. Install sleeves that are large enough to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Division 07 "Penetration Firestopping."

3.02 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 1. Install fittings that are large enough to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and pipe or pipe insulation.
 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Division 07 "Sheet Metal Flashing and Trim."
 3. Install section of cast-iron soil pipe to extend sleeve to **2 inches (50 mm)** above finished floor level.
 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 5. Use silicone sealant to seal the space around outside of stack-sleeve fittings.

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING (continued):

- B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Division 07.

3.03 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.04 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Use grout or silicone sealant to seal the space around outside of sleeve-seal fittings.

3.05 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.06 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller than **NPS 6 (DN 150)**: Steel pipe sleeves.
 - 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller than **NPS 4 (DN 100)**: Sleeve-seal fittings.
 - b. Piping **NPS 4 (DN 100)** and Larger: Steel pipe sleeves with sleeve-seal system.

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING (continued):

- 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs-on-Grade:
 - a. Piping Smaller than NPS 4 (DN 100): Sleeve-seal fittings.
 - b. Piping NPS 4 (DN 100) and Larger: Steel pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
4. Interior Partitions:
 - a. Piping Smaller Than NPS 6 (DN 150): Steel pipe sleeves.

END OF SECTION 220517

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SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.

1.03 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and polished brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished, chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
 - b. Chrome-Plated Piping: One-piece cast brass with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece stamped steel with polished, chrome-plated finish.

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING (continued):

- d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.
- e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.
- f. Bare Piping in Unfinished Service Spaces: One-piece cast brass with rough-brass finish.
- g. Bare Piping in Equipment Rooms: One-piece cast brass with rough-brass finish.

3.02 **FIELD QUALITY CONTROL**

- A. Using new materials, replace broken and damaged escutcheons.

END OF SECTION 220518

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Liquid-in-glass thermometers.
 - 2. Thermowells.
 - 3. Dial-type pressure gages.
 - 4. Gage attachments.
 - 5. Test plugs.
 - 6. Test-plug kits.
- B. Related Requirements:
 - 1. Section 221119 "Domestic Water Piping Specialties" for water meters inside the building.

1.03 ACTION SUBMITTALS

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

1.04 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of meter and gage.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Terence H.O. Co.; BX9 or comparable product by one of the following:
 - a. Weiss Instruments, Inc.
 - b. Winters Instruments - U.S.

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING (continued):

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 9-inch (229-mm) nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Non-reflective aluminum with permanently etched scale markings graduated in deg F (deg C).
7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
9. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.02 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR (copper nickel 90-10).
4. Material for Use with Steel Piping: CRES (stainless steel).
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1 (DN 15, DN 20, or NPS 25), ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.03 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Trerice H.O. Co.; 600CB or comparable product by one of the following:
 - a. Ashcroft Inc.
 - b. Miljoco Corporation.
 - c. Weiss Instruments, Inc.
 - d. Winters Instruments - U.S.
2. Standard: ASME B40.100.
3. Case: Solid-front, pressure relief type(s); cast aluminum; 4-1/2-inch (114-mm) nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING (continued):

7. Dial: Non-reflective aluminum with permanently etched scale markings graduated in psi (kPa).
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.04 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass ball, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads.

2.05 TEST PLUGS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Peterson Equipment Co., Inc.; Model 110 XL or comparable product by one of the following:
 1. Sisco Manufacturing Company, Inc.
 2. Trerice, H. O. Co.
 3. Weiss Instruments, Inc.
- B. Description: Test-station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: NPS 1/4 (DN 8), ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).
- F. Core Inserts: EPDM self-sealing rubber.

2.06 TEST-PLUG KITS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Peterson Equipment Co., Inc.; Model 1500XL or comparable product by one of the following:
 1. Miljoco Corporation.
 2. Sisco Manufacturing Company, Inc.
 3. Trerice, H. O. Co.
 4. Weiss Instruments, Inc.
- B. Furnish one test-plug kit(s) containing two thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
- C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F (minus 4 to plus 52 deg C).

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING (continued):

- D. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F (minus 18 to plus 104 deg C).
- E. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- (51- to 76-mm-) diameter dial and probe. Dial range shall be at least 0 to 200 psig (0 to 1380 kPa).
- F. Carrying Case: Metal or plastic, with formed instrument padding.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install thermowells with socket extending a minimum of 2 inches (51 mm) into fluid and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install valve and snubber in piping for each pressure gage for fluids.
- I. Install test plugs in piping tees.
- J. Install thermometers in the following locations:
 - 1. Inlet and outlet of each water heater.
- K. Install pressure gages in the following locations:
 - 1. Building water service entrance into building.
 - 2. Inlet and outlet of each pressure-reducing valve.

3.02 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING (continued):

3.03 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

3.04 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each domestic water heater shall be the following:
 - 1. Metal case, industrial-style, liquid-in-glass type.
- B. Thermometer stems shall be of length to match thermowell insertion length.

3.05 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F (Minus 20 to plus 70 deg C).
- B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F (0 to 150 deg C).
- C.

3.06 PRESSURE-GAGE SCHEDULE

- A. Pressure gages at discharge of each water service into building shall be the following:
 - 1. Solid-front, pressure-relief, direct-mounted, metal case.
- B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be the following:
 - 1. Solid-front, pressure-relief, direct-mounted, metal case.
 - 2. Test plug with EPDM self-sealing rubber inserts.

3.07 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Water Piping: 0 to 160 psi (0 to 1100 kPa).

END OF SECTION 220519

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SECTION 220523.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Bronze ball valves.

1.03 DEFINITIONS

- A. CWP: Cold working pressure.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
 - 1. Certification that products comply with NSF 61.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, and soldered ends.
 - 3. Set ball valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

SECTION 220523.12 - BALL VALVES FOR PLUMBING PIPING (continued):

- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded end valves.
 - 2. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
 - 1. Handlever
- H. Valves in Insulated Piping:
 - 1. Include 2-inch (50-mm) stem extensions.
 - 2. Extended operating handles of non-thermal conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
 - 3. Memory stops that are fully adjustable after insulation is applied.

2.02 BRONZE BALL VALVES

- A. Bronze Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-110 or MSS-145.
 - b. CWP Rating: 600 psig (4140 kPa).
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: soldered.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Full.

SECTION 220523.12 - BALL VALVES FOR PLUMBING PIPING (continued):

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- B. Select valves with the following end connections:
 - 1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.

3.04 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 (DN 50) and Smaller:
 - 1. **Bronze** ball valves, two-piece with full port and stainless steel trim. Provide with **solder** -joint ends.

END OF SECTION 220523.12

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SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Fastener systems.
- B. Related Requirements:
 - 1. Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.03 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 "Quality Requirements," to design trapeze pipe hangers and equipment supports.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT (continued):

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

2.02 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.03 TRAPEZE PIPE HANGERS

- A.** Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.04 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. [Cooper B-Line, Inc.](#)
 - b. [Flex-Strut Inc.](#)
 - c. [Unistrut Corporation; Tyco International, Ltd.](#)
- 2.
3. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
4. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
5. Channels: Continuous slotted carbon-steel channel with intumed lips.
6. Channel Width: Selected for applicable load criteria.
7. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
8. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
9. Metallic Coating: Electroplated zinc or Hot-dip galvanized.

B. Non-MFMA Manufacturer Metal Framing Systems:

- 1.
2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT (continued):

4. Channels: Continuous slotted carbon-steel channel with intumed lips.
5. Channel Width: Select for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
8. Metallic Coating: Hot-dip galvanized

2.05 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.06 PIPE-POSITIONING SYSTEMS

- A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.07 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.08 MATERIALS

- A. Aluminum: **ASTM B 221** (**ASTM B 221M**).
- B. Carbon Steel: ASTM A 1011/A 1011M.
- C. Structural Steel: ASTM A 36/A 36M carbon-steel plates, shapes, and bars; black and galvanized.
- D. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
 1. Properties: Non-staining, noncorrosive, and nongaseous.
 2. Design Mix: **5000-psi** (**34.5-MPa**), 28-day compressive strength.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Comply with requirements in Division 07 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT (continued):

- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

3.02 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 / D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT (continued):

3.05 PAINTING

- A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 09.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A 780 / A 780M.

3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - 2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
 - 3. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT (continued):

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
- K. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- L. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- N. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Pipe labels.
 - 3. Valve tags.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: White.
 - 3. Background Color: Black.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 - 6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT (continued):

- B. Label Content: Include equipment's Drawing designation or unique equipment number.
- C. Equipment Label Schedule: For each item of equipment to be labeled, tabulate equipment label content. Equipment schedule shall be included in operation and maintenance data.

2.02 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.03 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.
 - 1. Tag Material: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link chain.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

2.04 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

2.05 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT (continued):

2.06 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

2.07 PIPE LABEL INSTALLATION

- A. **099600 "High-Performance Coatings."]**
- B. **Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, [with painted, color-coded bands or rectangles] on each piping system.**
- C. **Identification Paint: Use for contrasting background.**
- D. **Stencil Paint: Use for pipe marking.**
- E. **Pipe Label Locations:** Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- F. **Directional Flow Arrows:** Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions. Install marker tape with arrows around the entire circumference of the pipe at the beginning and end of the pipe-label content.
- G. **Pipe Label Color Schedule:**
 - 1. Domestic Water Piping
 - a. Background: Safety green.
 - b. Letter Colors: White.

2.08 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. **Valve-Tag Application Schedule:** Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. **Valve-Tag Size and Shape:**

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT (continued):

- a. Cold Water: 1-1/2 inches (38 mm), round.
 - b. Hot Water: 1-1/2 inches (38 mm), round.
 - c. Sanitary Waste: 1-1/2 inches (38 mm), round.
- 2. Valve-Tag Colors:
 - a. Cold Water: Natural.
 - b. Hot Water: Natural.

END OF SECTION 220553

SECTION 220719.11 - INSULATION FOR DOMESTIC COLD-WATER PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic cold-water piping.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

SECTION 220719.11 - INSULATION FOR DOMESTIC COLD-WATER PIPING (continued):

1.06 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing, where applicable.

1.07 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 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. **Pittsburgh Corning Corporation; Foamglas.**
 - 2. Block Insulation: ASTM C552, Type I.
 - 3. Special-Shaped Insulation: ASTM C552, Type III.
 - 4. Preformed Pipe Insulation without Jacket: Comply with ASTM C552, Type II, Class 1.
 - 5. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C552, Type II, Class 2.
 - 6. Factory fabricate shapes according to ASTM C450 and ASTM C585.

SECTION 220719.11 - INSULATION FOR DOMESTIC COLD-WATER PIPING (continued):

2.02 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of **minus 100 to plus 200 deg F (minus 73 to plus 93 deg C)**.
 - 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. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.03 MASTICS AND COATINGS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.

SECTION 220719.11 - INSULATION FOR DOMESTIC COLD-WATER PIPING (continued):

2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 3. Service Temperature Range: **Minus 20 to plus 180 deg F** (Minus 29 to plus 82 deg C).
 4. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
 5. Color: White.
- C. Vapor-Retarder Mastic: Solvent based; suitable for outdoor use on below-ambient services.
1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
 - b. Eagle Bridges - Marathon Industries; 570.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
 2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 3. Service Temperature Range: **Minus 50 to plus 220 deg F** (Minus 46 to plus 104 deg C).
 4. Color: White.

2.04 SEALANTS

A. Joint Sealants for Cellular-Glass Products:

1. Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
 - d. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: **Minus 100 to plus 300 deg F** (Minus 73 to plus 149 deg C).
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Metal Jacket Flashing Sealants:

1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.

SECTION 220719.11 - INSULATION FOR DOMESTIC COLD-WATER PIPING (continued):

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: **Minus 40 to plus 250 deg F** (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Flashing Sealants:

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: **Minus 40 to plus 250 deg F** (Minus 40 to plus 121 deg C).
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.05 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.

2.06 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric: Approximately **2 oz./sq. yd. (68 g/sq. m)** with a thread count of **10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm)** for covering pipe and pipe fittings.
 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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Chil-Glas Number 10.

2.07 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.
- B. Metal Jacket:

SECTION 220719.11 - INSULATION FOR DOMESTIC COLD-WATER PIPING (continued):

1. Aluminum Jacket: Comply with **ASTM B209** (**ASTM B209M**), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: **2.5-mil-** (**0.063-mm-**) thick polysurlyn.
 - d. Moisture Barrier for Outdoor Applications: **2.5-mil-** (**0.063-mm-**) thick polysurlyn.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.08 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
 1. Width: **3 inches** (**75 mm**).
 2. Thickness: **11.5 mils** (**0.29 mm**).
 3. Adhesion: **90 ounces force/inch** (**1.0 N/mm**) in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: **40 lbf/inch** (**7.2 N/mm**) in width.
 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.09 SECUREMENTS

- A. Bands:
 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. **ITW Insulation Systems; Gerrard Strapping and Seals.**
 - b. **RPR Products, Inc.; Insul-Mate Strapping and Seals.**
 2. Stainless Steel: ASTM A167 or ASTM A240/A240M, Type 304; **0.015 inch** (**0.38 mm**) thick, **1/2 inch** (**13 mm**) wide with wing seal.
- B. Wire: **0.062-inch** (**1.6-mm**) soft-annealed, stainless steel.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

SECTION 220719.11 - INSULATION FOR DOMESTIC COLD-WATER PIPING (continued):

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Below Ambient Systems:
 - 1. Provide continuous vapor barrier; seal joints, longitudinal seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic and joint sealant.
 - 2. Where mastic is indicated provide vapor-barrier mastic as required for indoor or outdoor application.
 - 3. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous vapor barrier and thermal integrity unless otherwise indicated.
 - 4. Install insulation continuously through hangers and around anchor attachments.
 - 5. Extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

SECTION 220719.11 - INSULATION FOR DOMESTIC COLD-WATER PIPING (continued):

- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.04 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
 - 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Division 07 for firestopping and fire-resistive joint sealers.
 - 2.

3.05 INSTALLATION OF CELLULAR-GLASS INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Provide factory applied ASJ-SSL jacket.
 - 2. Create a water stop between insulation and pipe by brushing vapor barrier mastic on pipe around circumference of pipe every 3 feet.
- B. Insulation Installation on Pipe Flanges, Fittings, Elbows, Valves and Pipe Specialties:
 - 1. Provide insulation without factory applied jacket.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or

SECTION 220719.11 - INSULATION FOR DOMESTIC COLD-WATER PIPING (continued):

- plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. Provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Install preformed pipe insulation to outer diameter of pipe flange. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with insulating cement.
 7. Secure mitered sections or segmented insulation with wire or bands.
 8. Cover pipe fittings, valves, strainers, flanges, unions, and other specialties and any segmented insulated surfaces with a layer of finishing cement and install field-applied glass-cloth jacket.
 9. Apply vapor-barrier mastic at exposed ends of insulation at pipe flanges, unions, and fittings.
 10. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.06 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with **2-inch (50-mm)** overlap at seams and joints.
2. Embed glass cloth between two **0.062-inch- (1.6-mm-)** thick coats of mastic.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.
4. Finish to achieve smooth, uniform finish.

B. Where metal jackets are indicated, install with **2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands **12 inches (300 mm)** o.c. and at end joints.**

1. Do not install metal jacket over glass-cloth jacket.

3.07 FINISHES

A. Do not field paint aluminum jackets.

SECTION 220719.11 - INSULATION FOR DOMESTIC COLD-WATER PIPING (continued):

3.08 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.09 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Domestic Water Piping:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 2 inches (50 mm) thick.
 - 2.

3.10 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
 - 1. Aluminum, Corrugated: 0.024 inch (0.61 mm) thick.

END OF SECTION 220719.11

SECTION 220719.12 - INSULATION FOR DOMESTIC HOT-WATER PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic hot-water piping.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).
- B. Shop Drawings:
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at pipe expansion joints for each type of insulation.
 - 3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 4. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - 5. Detail application of field-applied jackets.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

SECTION 220719.12 - INSULATION FOR DOMESTIC HOT-WATER PIPING (continued):

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.06 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing, where applicable.

1.07 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. **Johns Manville; Micro-Lok HP.**
 - b. **Owens Corning; SSL II with ASJ Max Fiberglas Pipe Insulation.**
 - 2. Type I, **850 Deg F (454 Deg C)** Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-

SECTION 220719.12 - INSULATION FOR DOMESTIC HOT-WATER PIPING (continued):

applied jacket requirements are specified in "Factory-Applied Jackets" Article. UL listed and labeled for installation over PVC and other polymer pipes within a plenum.

2.02 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.
 - 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. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.03 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

SECTION 220719.12 - INSULATION FOR DOMESTIC HOT-WATER PIPING (continued):

2.04 MASTICS AND COATINGS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
 - 2. Water-Vapor Permeance: ASTM E96, greater than **1.0 perm** (**0.66 metric perms**) at manufacturer's recommended dry film thickness.
 - 3. Service Temperature Range: **Minus 20 to plus 180 deg F** (**Minus 29 to plus 82 deg C**).
 - 4. Color: White.

2.05 SEALANTS

- A. Metal Jacket Flashing Sealants:
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: **Minus 40 to plus 250 deg F** (**Minus 40 to plus 121 deg C**).
 - 5. Color: Aluminum.
 - 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:
 - 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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

SECTION 220719.12 - INSULATION FOR DOMESTIC HOT-WATER PIPING (continued):

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: **Minus 40 to plus 250 deg F** (Minus 40 to plus 121 deg C).
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.06 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.

2.07 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric: Approximately **2 oz./sq. yd. (68 g/sq. m)** with a thread count of **10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm)** for covering pipe and pipe fittings.
 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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Chil-Glas Number 10.

2.08 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: White.
 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

SECTION 220719.12 - INSULATION FOR DOMESTIC HOT-WATER PIPING (continued):

C. Metal Jacket:

1. Aluminum Jacket: Comply with **ASTM B209 (ASTM B209M)**, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: **2.5-mil- (0.063-mm-)** thick polysurlyn.
 - d. Moisture Barrier for Outdoor Applications: **2.5-mil- (0.063-mm-)** thick polysurlyn.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.09 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
 1. Width: **3 inches (75 mm)**.
 2. Thickness: **11.5 mils (0.29 mm)**.
 3. Adhesion: **90 ounces force/inch (1.0 N/mm)** in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: **40 lbf/inch (7.2 N/mm)** in width.
 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
 1. Width: **2 inches (50 mm)**.
 2. Thickness: **6 mils (0.15 mm)**.
 3. Adhesion: **64 ounces force/inch (0.7 N/mm)** in width.
 4. Elongation: 500 percent.
 5. Tensile Strength: **18 lbf/inch (3.3 N/mm)** in width.

2.10 SECUREMENTS

A. Bands:

1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. **ITW Insulation Systems; Gerrard Strapping and Seals.**
 - b. **RPR Products, Inc.; Insul-Mate Strapping and Seals.**
2. Stainless Steel: ASTM A167 or ASTM A240/A240M, Type 304; **0.015 inch (0.38 mm)** thick, **1/2 inch (13 mm)** wide with wing seal.

- B. Wire: **0.062-inch (1.6-mm)** soft-annealed, stainless steel.

SECTION 220719.12 - INSULATION FOR DOMESTIC HOT-WATER PIPING (continued):

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Above Ambient Systems:
 - 1. Where mastic is indicated provide breather mastic.
 - 2. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal integrity unless otherwise indicated.

SECTION 220719.12 - INSULATION FOR DOMESTIC HOT-WATER PIPING (continued):

- 3. Install insulation continuously through hangers and around anchor attachments.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Cleanouts.

3.04 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
 - 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Division 07 for firestopping and fire-resistive joint sealers.

3.05 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Provide factory applied ASJ-SSL jacket.
- B. Insulation Installation on Pipe Flanges, Fittings, Elbows, Valves and Pipe Specialties:

SECTION 220719.12 - INSULATION FOR DOMESTIC HOT-WATER PIPING (continued):

1. Insulate pipe elbows and tee fittings using preformed fitting insulation. Each piece shall be butted tightly against adjoining piece.
2. Insulate flanges and unions using a section of oversized preformed pipe insulation. Install preformed pipe insulation to outer diameter of pipe flange. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with insulating cement.
3. Insulate strainers, valves, and other pipe specialties using preformed fitting insulation. When preformed sections are not available, install mitered sections of pipe insulation. Secure mitered sections with wire or bands.
4. Arrange valve insulation to permit access to packing and to allow valve operation without disturbing insulation.
5. In concealed locations install fitted PVC cover over preformed fitting insulation. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
6. Cover pipe fittings, valves, strainers, flanges, unions, and other specialties in exposed locations and any segmented insulated surfaces with a layer of finishing cement and install field-applied glass-cloth jacket.
7. Apply breather mastic at exposed ends of insulation at pipe flanges, unions, and fittings.
8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulation Installation on Instrument Connections:

1. Install insulation on instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes.
2. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with mastic.
3. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.06 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of mastic.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.
4. Finish to achieve smooth, uniform finish.

B. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

1. Do not install metal jacket over glass-cloth jacket.

3.07 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below. Color per schedule below.

SECTION 220719.12 - INSULATION FOR DOMESTIC HOT-WATER PIPING (continued):

1. Semi-gloss Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, semi-gloss, latex-emulsion size.
2. Paint exposed piping without field applied metal jacket.
- B. Color: Final color as selected by Engineer. Vary first and second coats to allow visual inspection of the completed Work.
 1. White.
- C. Do not field paint aluminum jackets.

3.08 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.09 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Hot and Recirculated Hot Water:
 1. **NPS 1-1/4 (DN 32)** and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: **1-1/2 inch (38 mm)** thick.

3.10 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 1. None.
- D. Piping, Exposed:
 1. Aluminum, Corrugated: **0.016 inch (0.41 mm)** thick.
- E. Exposed fittings, valves, strainers, flanges, unions, and other specialties:
 1. Glass cloth jacket.

END OF SECTION 220719.12

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:

1. Copper tube and fittings.
2. PVC pipe and fittings.
3. Piping joining materials.
4. Transition fittings.
5. Dielectric fittings.

1.03 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

1.04 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

1.05 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 1. Notify Owner no fewer than 5 days in advance of proposed interruption of water service.
 2. Do not interrupt water service without Owner's written permission.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372.

SECTION 221116 - DOMESTIC WATER PIPING (continued):

2.02 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: **ASTM B 88, Type L** (ASTM B 88M, Type B) water tube, drawn temper.
- B. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- D. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.

2.03 PVC PIPE AND FITTINGS

- A. PVC Pipe: ASTM D 1785, Schedule 40.
- B. PVC Socket Fittings: ASTM D 2466 for Schedule 40.
- C. PVC Schedule 80 Threaded Fittings: ASTM D 2464.

2.04 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
 - 1. AWWA C110/A21.10, rubber, flat face, **1/8 inch (3.2 mm)** thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- F. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

SECTION 221116 - DOMESTIC WATER PIPING (continued):

2.05 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Sleeve-Type Transition Coupling: AWWA C219.
- D. Plastic-to-Metal Transition Fittings:
 - 1. Description:
 - a. One end with threaded brass insert and one solvent-cement-socket **or threaded** end.
- E. Plastic-to-Metal Transition Unions:
 - 1. Description:
 - a. Brass or stainless-steel threaded end.
 - b. Solvent-cement-joint or threaded plastic end.
 - c. Rubber O-ring.
 - d. Union nut.

2.06 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Standard: ASSE 1079.
 - 2. Pressure Rating: .
 - 3. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Standard: ASSE 1079.
 - 2. Factory-fabricated, bolted, companion-flange assembly.
 - 3. Pressure Rating: .
 - 4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
 - 1. Nonconducting materials for field assembly of companion flanges.
 - 2. Pressure Rating: **150 psig (1035 kPa)**.
 - 3. Gasket: Neoprene or phenolic.
 - 4. Bolt Sleeves: Phenolic or polyethylene.
 - 5. Washers: Phenolic with steel backing washers.

SECTION 221116 - DOMESTIC WATER PIPING (continued):

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.02 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install water-pressure-reducing valves downstream from shutoff valves if static service pressure exceeds 60 psig. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
- G. Install domestic water piping level **without pitch** and plumb.
- H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- K. Install piping to permit valve servicing.
- L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- M. Install piping free of sags and bends.
- N. Install fittings for changes in direction and branch connections.
- O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- P. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

SECTION 221116 - DOMESTIC WATER PIPING (continued):

- Q. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."
- R. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.03 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- F. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - 2. PVC Piping: Join according to ASTM D 2855.
- G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.04 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for **NPS 1-1/2 (DN 40)** and Smaller: Fitting-type coupling.

SECTION 221116 - DOMESTIC WATER PIPING (continued):

- C. Transition Fittings in Aboveground Domestic Water Piping **NPS 2 (DN 50)** and Smaller: Plastic-to-metal transition unions.

3.05 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for **NPS 2 (DN 50)** and Smaller: Use dielectric unions.

3.06 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. MSS Type 1, adjustable, steel clevis hangers.
 - 3. Multiple, Straight, Horizontal Piping: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of **3/8 inch (10 mm)**.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. **NPS 3/4 (DN 20)** and Smaller: **60 inches (1500 mm)** with **3/8-inch (10-mm)** rod.
 - 2. **NPS 1 and NPS 1-1/4 (DN 25 and DN 32)**: **72 inches (1800 mm)** with **3/8-inch (10-mm)** rod.
 - 3. **NPS 1-1/2 and NPS 2 (DN 40 and DN 50)**: **96 inches (2400 mm)** with **3/8-inch (10-mm)** rod.
 - 4. **NPS 2-1/2 (DN 65)**: **108 inches (2700 mm)** with **1/2-inch (13-mm)** rod.
 - 5. **NPS 3 to NPS 5 (DN 80 to DN 125)**: **10 feet (3 m)** with **1/2-inch (13-mm)** rod.
 - 6. **NPS 6 (DN 150)**: **10 feet (3 m)** with **5/8-inch (16-mm)** rod.
 - 7. **NPS 8 (DN 200)**: **10 feet (3 m)** with **3/4-inch (19-mm)** rod.
- E. Install supports for vertical copper tubing every **10 feet (3 m)**.
- F. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. **NPS 2 (DN 50)** and Smaller: **48 inches (1200 mm)** with **3/8-inch (10-mm)** rod.
 - 2. **NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90)**: **48 inches (1200 mm)** with **1/2-inch (13-mm)** rod.
 - 3. **NPS 4 and NPS 5 (DN 100 and DN 125)**: **48 inches (1200 mm)** with **5/8-inch (16-mm)** rod.
 - 4. **NPS 6 (DN 150)**: **48 inches (1200 mm)** with **3/4-inch (19-mm)** rod.
 - 5. **NPS 8 (DN 200)**: **48 inches (1200 mm)** with **7/8-inch (22-mm)** rod.
- G. Install supports for vertical PVC piping every **48 inches (1200 mm)**.
- H. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

SECTION 221116 - DOMESTIC WATER PIPING (continued):

3.07 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
 - 4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.08 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

3.09 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

SECTION 221116 - DOMESTIC WATER PIPING (continued):

- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure but not less than 150 psig (1034 kPa), without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.10 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Adjust calibrated balancing valves to flows indicated.
 - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.

SECTION 221116 - DOMESTIC WATER PIPING (continued):

- c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Underground, domestic water, building-service piping, **NPS 3 (DN 80)** and smaller, shall be one of the following:
 - 1. PVC, Schedule 40; socket fittings; and solvent-cemented joints.
- D. Aboveground domestic water piping, **NPS 2 (DN 50)** and smaller, shall be one of the following:
 - 1. Hard copper tube, **ASTM B 88, Type L (ASTM B 88M, Type B)**; wrought-copper, solder-joint fittings; and soldered joints.

3.13 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball or gate valves for piping **NPS 2 (DN 50)** and smaller.
 - 2. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
 - 3. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

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SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:

1. Vacuum breakers.
2. Hose bibbs.
3. Wall hydrants.
4. Water-hammer arresters.
5. Trap-seal primer device.

1.03 DEFINITIONS

- A. AMI: Advanced Metering Infrastructure.
- B. FKM: A family of fluoroelastomer materials defined by ASTM D1418.

1.04 ACTION SUBMITTALS

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

1.05 INFORMATIONAL SUBMITTALS

- A. Test and inspection reports.
- B. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES (continued):

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.02 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: **125 psig (860 kPa)** unless otherwise indicated.

2.03 VACUUM BREAKERS

- A. Hose-Connection Vacuum Breakers:

1. **Basis-of-Design Product:** Subject to compliance with requirements, provide Watts; 8B or comparable product by one of the following:
 - a. [Conbraco Industries, Inc](#)
 - b. [Zurn Industries, LLC](#)
 - c. [Plumbing Products Group](#)
 - d. [Wilkins Water Control Products](#)
2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Rough bronze.

- B. Pressure Vacuum Breakers:

1. **Basis-of-Design Product:** Subject to compliance with requirements, provide Watts; LF800M4QT or comparable product by one of the following:
 - a. [Conbraco Industries, Inc](#)
 - b. [Zurn Industries, LLC](#)
 - c. [Plumbing Products Group](#)
 - d. [Wilkins Water Control Products](#)
2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: **5 psig (35 kPa)** maximum, through middle third of flow range.
5. Accessories:
 - a. Valves: Ball type, on inlet and outlet.

2.04 HOSE BIBBS

- A. Hose Bibbs:
 1. Standard: ASME A112.18.1 for sediment faucets.

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES (continued):

2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: **NPS 1/2 or NPS 3/4 (DN 15 or DN 20)** threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: **125 psig (860 kPa)**.
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.05 WALL HYDRANTS

A. Non-freeze Wall Hydrants:

1. **Basis-of-Design Product:** Subject to compliance with requirements, provide Zurn; Z1320-C or comparable product by one of the following:
 - a. **Josam Company.**
 - b. **MIFAB, Inc.**
 - c. **Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.**
 - d. **Watts Drainage Products.**
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: **125 psig (860 kPa)**.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: **NPS 3/4 or NPS 1 (DN 20 or DN 25)**.
7. Outlet, Concealed: With integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Operating Keys(s): One with each wall hydrant.

B. Moderate-Climate Wall Hydrants:

1. **Basis-of-Design Product:** Subject to compliance with requirements, provide Zurn; Z130-C or comparable product by one of the following:
 - a. **Josam Company.**
 - b. **MIFAB, Inc.**
 - c. **Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.**
 - d. **Watts Drainage Products.**
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: **125 psig (860 kPa)**.
4. Operation: Loose key.
5. Inlet: **NPS 3/4 or NPS 1 (DN 20 or DN 25)**.
6. Outlet, Concealed:

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES (continued):

- a. With integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
 - b. Garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounted with cover.
 8. Box and Cover Finish: Polished nickel bronze.
 9. Operating Key(s): One with each wall hydrant.

2.06 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. **Basis-of-Design Product:** Subject to compliance with requirements, provide Zurn; 1250XL or comparable product by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Precision Plumbing Products, Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Watts Drainage Products.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.07 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. **Basis-of-Design Product:** Subject to compliance with requirements, provide Precision Plumbing Products; P1-500 or comparable product by one of the following:
 - a. MIFAB, Inc.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig (860 kPa) minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.
8. Provide adjusting screw to adjust between high and low pressures.

PART 3 - EXECUTION

3.01 INSTALLATION OF PIPING SPECIALTIES

- A. Non-freeze, Draining-Type Post Hydrants: Install with 1 cu. yd. (0.75 cu. m) of crushed gravel around drain hole. Set post hydrants in concrete paving or in 1 cu. ft. (0.03 cu. m) of concrete block at grade.

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES (continued):

- B. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.
- C. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.02 PIPING CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.03 ADJUSTING

- A. Adjust each pressure vacuum breaker, reduced-pressure-principle backflow preventer, and double-check, backflow-prevention assembly in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

3.04 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections.
 - 1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer, and double-check, backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 221119

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SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Hubless, cast-iron soil pipe and fittings.
 - 2. PVC pipe and fittings.
 - 3. Specialty pipe fittings.
 - 4. Plenum fire wrap.

1.03 ACTION SUBMITTALS

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

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.05 FIELD CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Owner no fewer than five days in advance of proposed interruption of sanitary waste service.
 - 2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

1.06 WARRANTY

- A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

SECTION 221316 - SANITARY WASTE AND VENT PIPING (continued):

1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

2.02 PIPING MATERIALS

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.03 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. AB & I Foundry; a part of the McWane family of companies.
 2. Charlotte Pipe and Foundry Company.
 3. Tyler Pipe; a part of McWane family of companies.
- B. Pipe and Fittings: ASTM A 888 or CISPI 301.
- C. CISPI, Hubless-Piping Couplings:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. MIFAB, Inc.
 - c. Mission Rubber Company; a division of MCP Industries, Inc.
 2. Standards: ASTM C 1277 and CISPI 310.
 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- D. Heavy-Duty, Hubless-Piping Couplings:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky (SD 4000).
 - b. Clamp-All Corp (Hi-Torq 80).
 - c. MIFAB, Inc (MI-XHUB).
 - d. Mission Rubber Company; a division of MCP Industries, Inc (HeavyWeight).
 2. Standards: ASTM C 1277 and ASTM C 1540.
 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.04 PVC PIPE AND FITTINGS

- A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

SECTION 221316 - SANITARY WASTE AND VENT PIPING (continued):

- B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Adhesive Primer: ASTM F 656.
 - 1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Solvent Cement: ASTM D 2564.
 - 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.05 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 - 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
 - 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 - 3. Unshielded, Nonpressure Transition Couplings:
 - a. Standard: ASTM C 1173.
 - b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - c. End Connections: Same size as and compatible with pipes to be joined.
 - d. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
 - 4. Pressure Transition Couplings:
 - a. Standard: AWWA C219.
 - b. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
 - c. Center-Sleeve Material: Manufacturer's standard.
 - d. Gasket Material: Natural or synthetic rubber.
 - e. Metal Component Finish: Corrosion-resistant coating or material.
- B. Dielectric Fittings:

SECTION 221316 - SANITARY WASTE AND VENT PIPING (continued):

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:
 - a. Description:
 - 1) Standard: ASSE 1079.
 - 2) Pressure Rating: **125 psig** (860 kPa) minimum at **180 deg F** (82 deg C).
 - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
3. Dielectric-Flange Insulating Kits:
 - a. Description:
 - 1) Nonconducting materials for field assembly of companion flanges.
 - 2) Pressure Rating: **150 psig** (1035 kPa).
 - 3) Gasket: Neoprene or phenolic.
 - 4) Bolt Sleeves: Phenolic or polyethylene.
 - 5) Washers: Phenolic with steel backing washers.

2.06 PLENUM FIRE WRAP

- A. Material: High-temperature fiber blanket thermal insulation encapsulated in fiberglass-reinforced aluminum foil.
- B. Density: 6 pcf.
- C. Thickness: 1/2 inch.
- D. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

PART 3 - EXECUTION

3.01 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31.

3.02 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
 2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

SECTION 221316 - SANITARY WASTE AND VENT PIPING (continued):

- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
 - 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
 - 2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
 - a. Straight tees, elbows, and crosses may be used on vent lines.
 - 3. Do not change direction of flow more than 90 degrees.
 - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
 - a. Reducing size of waste piping in direction of flow is prohibited.
- K. Lay buried building waste piping beginning at low point of each system.
 - 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
 - 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
 - 3. Maintain swab in piping and pull past each joint as completed.
- L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Waste: 2 percent downward in direction of flow for piping **NPS 3 (DN 80)** and smaller; 1 percent downward in direction of flow for piping **NPS 4 (DN 100)** and larger.
 - 2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- N. Install aboveground PVC piping according to ASTM D 2665.
- O. Install underground PVC piping according to ASTM D 2321.
- P. Wrap PVC piping installed in plenums with fire resistant wrap.

SECTION 221316 - SANITARY WASTE AND VENT PIPING (continued):

- Q. Install engineered soil and waste and vent piping systems as follows:
1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
- R. Plumbing Specialties:
1. Install backwater valves in sanitary waster gravity-flow piping.
 - a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
 2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
 - a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
 - b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
 3. Install drains in sanitary waste gravity-flow piping.
 - a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- S. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- T. Install sleeves for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install sleeve seals for piping penetrations of concrete walls and slabs.
1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.03 JOINT CONSTRUCTION

- A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- B. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- C. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

SECTION 221316 - SANITARY WASTE AND VENT PIPING (continued):

2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.04 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Unshielded, nonpressure transition couplings.
3. In Aboveground Force Main Piping: Fitting-type transition couplings.
4. In Underground Force Main Piping:
 - a. **NPS 1-1/2 (DN 40)** and Smaller: Fitting-type transition couplings.
 - b. **NPS 2 (DN 50)** and Larger: Pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for **NPS 2 (DN 50)** and Smaller: Use dielectric unions.
3. Dielectric Fittings for **NPS 2-1/2 to NPS 4 (DN 65 to DN 100)**: Use dielectric flange kits.
4. Dielectric Fittings for **NPS 5 (DN 125)** and Larger: Use dielectric flange kits.

3.05 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:
 - a. **100 Feet (30 m)** and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than **100 Feet (30 m)**: MSS Type 43, adjustable roller hangers.
 - c. Longer Than **100 Feet (30 m)** if Indicated: MSS Type 49, spring cushion rolls.
7. Multiple, Straight, Horizontal Piping Runs **100 Feet (30 m)** or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install hangers for cast-iron, steel, and copper soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Install hangers for PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping and tubing within **12 inches (300 mm) of each fitting, valve, and coupling.**

E. Support vertical runs of cast iron, steel, and copper soil piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

SECTION 221316 - SANITARY WASTE AND VENT PIPING (continued):

- F. Support vertical runs of PVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.06 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect waste and vent piping to the following:
 - 1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 - 5. Comply with requirements for backwater valves, cleanouts, and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
 - 6. Equipment: Connect waste piping as indicated.
 - a. Provide shutoff valve if indicated and union for each connection.
 - b. Use flanges instead of unions for connections **NPS 2-1/2 (DN 65)** and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
 - 1. Install unions, in piping **NPS 2 (DN 50)** and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping **NPS 2-1/2 (DN 65)** and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.07 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.
- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.08 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

SECTION 221316 - SANITARY WASTE AND VENT PIPING (continued):

- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
 - a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
 - a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa).
 - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
 - c. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
 - a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa).
 - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
 - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
 - d. Inspect plumbing fixture connections for gas and water leaks.
 - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 6. Prepare reports for tests and required corrective action.

3.09 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

SECTION 221316 - SANITARY WASTE AND VENT PIPING (continued):

- E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 **PIPING SCHEDULE**

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, vent piping **NPS 4 (DN 100)** and smaller shall be any of the following:
 - 1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
 - 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- C. Underground, soil, waste, and vent piping **NPS 4 (DN 100)** and smaller shall be any of the following:
 - 1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Cleanouts.
 - 2. Miscellaneous sanitary drainage piping specialties.

1.03 DEFINITIONS

- A. ABS: Acrylonitrile butadiene styrene.
- B. PVC: Polyvinyl chloride.

1.04 ACTION SUBMITTALS

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

1.05 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.01 ASSEMBLY DESCRIPTIONS

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES (continued):

2.02 CLEANOUTS

A. Plastic Floor Cleanouts:

1. **Basis-of-Design Product:** Subject to compliance with requirements, provide Zurn; CO-2449 or a comparable product by one of the following:
 - a. **NDS Inc.**
 - b. **Sioux Chief Manufacturing Company, Inc.**
2. Size: Same as connected branch.
3. Body: PVC.
4. Outlet Connection: PVC hub.
5. Closure Plug: ABS plug with tapered threads.
6. Adjustable Housing Material: PVC with threads.
7. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
8. Frame and Cover Shape: Round.
9. Top Loading Classification: Medium Duty.
10. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.

2.03 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
 - a. **NPS 2 (DN 50): 4-inch- (100-mm-)** minimum water seal.
 - b. **NPS 2-1/2 (DN 65) and Larger: 5-inch- (125-mm-)** minimum water seal.

B. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with **NPS 1/2 (DN 15)** side inlet.

C. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend **2 inches (51 mm)** above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

D. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES (continued):

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to **NPS 4 (DN 100)**. Use **NPS 4 (DN 100)** for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of **50 feet (15 m)** for piping **NPS 4 (DN 100)** and smaller and **100 feet (30 m)** for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- E. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.
- F. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.
- G. Install wood-blocking reinforcement for wall-mounting-type specialties.
- H. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.02 PIPING CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment, to allow service and maintenance.

3.03 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

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SECTION 221319.13 - SANITARY DRAINS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Floor drains.

1.03 DEFINITIONS

- A. PVC: Polyvinyl chloride.

1.04 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 DRAIN ASSEMBLIES

- A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.02 FLOOR DRAINS

- A. Cast-Iron Floor Drains:
 - 1. **Basis-of-Design Product:** Subject to compliance with requirements, provide Watts; FD-100-A or a comparable product by one of the following:
 - a. **Josam Company; Josam Div.**
 - b. **MIFAB, Inc.**
 - c. **Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.**
 - d. **Zurn Plumbing Products Group; Specification Drainage Operation** (Z415B).
 - 2. Standard: ASME A112.6.3.
 - 3. Pattern: Floor drain.
 - 4. Body Material: Gray iron.
 - 5. Seepage Flange: Required.

SECTION 221319.13 - SANITARY DRAINS (continued):

6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Top or Strainer Material: Nickel bronze.
10. Top Shape: Round.
11. Dimensions of Top or Strainer: 6 inch (152 mm).
12. Top Loading Classification: Medium Duty.
13. Funnel: Provide where indicated on plans.
14. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
15. Trap Material: Cast iron.
16. Trap Pattern: Deep-seal P-trap.
17. Trap Features: Cleanout and trap-seal primer valve drain connection.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 1. Position floor drains for easy access and maintenance.
 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
 3. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
 - b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
 - c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.
 4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
 - a. Maintain integrity of waterproof membranes where penetrated.
 5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

3.02 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Comply with requirements in Section 221319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.
- C. Install piping adjacent to equipment to allow service and maintenance.

SECTION 221319.13 - SANITARY DRAINS (continued):

3.03 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319.13

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SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Commercial, electric, storage, domestic-water heaters.
 - 2. Domestic-water heater accessories.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
 - 1. Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of electric, domestic-water heater.
- B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- C. Field quality-control reports.
- D. Sample Warranty: For special warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For electric, domestic-water heaters to include emergency, operation, and maintenance manuals.

1.06 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS (continued):

1.07 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Electric, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Three years.
 - 2) Controls and Other Components: One year.
 - b. Expansion Tanks: Five years.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.
- B. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.
- C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.02 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

- A. Commercial, Electric, Storage, Domestic-Water Heaters:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. A. O. Smith Corporation.
 - b. Bradford White Corporation.
 - c. Lochinvar, LLC.
 - d. PVI; A WATTS Brand.
 - e. State Industries.
 - 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 - 3. Standard: UL 1453.
 - 4. Storage-Tank Construction: ASME-code, steel vertical arrangement.

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS (continued):

- a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
 - 1) NPS 2 (DN 50) and Smaller: Threaded ends in accordance with ASME B1.20.1.
 - 2) NPS 2-1/2 (DN 65) and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges, and in accordance with ASME B16.24 for copper and copper-alloy flanges.
 - b. Pressure Rating: 150 psig (1035 kPa).
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
5. Factory-Installed, Storage-Tank Appurtenances:
- a. Anode Rod: Replaceable magnesium.
 - b. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - c. Insulation: Comply with ASHRAE/IES 90.1.
 - d. Jacket: Steel with enameled finish or high-impact composite material.
 - e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
 - f. Temperature Control: Adjustable thermostat.
 - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
6. Special Requirements: NSF 5 construction.
7. 221119"DomesticWaterPipingSpecialties."
8. Insulation:Complywith[ASHRAE/IES90.1][ASHRAE90.2].
9. Jacket:Steelwithenameledfinishorhigh-impactcompositematerial.
10. HeatingElement:One;electric,screw-inimmersiontype.
11. TemperatureControl:Adjustablethermostat.
12. SafetyControl:High-temperature-limitcutoffdeviceorsystem.
13. PowerSupplyCord:24to72inches(610to1830mm)withplug.
14. ReliefValve:ASMERatedandstampedforcombinationtemperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
15. Residential, Collector-to-Tank, Solar, Electric, Domestic-Water Heaters:
16. <Double click hereto find, evaluate, and insert list of manufacturers and products.>
17. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
18. Standard: UL 174 with piping and electrical connections for UL 1279 solar collectors system.
19. Storage-Tank Construction: Steel.
20. Tappings: ASME B1.20.1 pipe thread.
21. Pressure Rating: 150 psig (1035 kPa).
22. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
23. Factory-Installed, Storage-Tank Appurtenances:
24. Sensor electrical connections and tank stud for sensor.
25. Anode Rod: Replaceable magnesium.
26. Dip Tube: Required unless cold-water inlet is near bottom of tank.
27. Drain Valve: Corrosion-resistant metal with hose-end connection.
28. Insulation: Comply with [ASHRAE/IES 90.1] [ASHRAE 90.2].
29. Jacket: Steel with enameled finish.
30. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS (continued):

31. HeatingElement:Electric,screw-inimmersiontype.
32. TemperatureControl:Adjustablethermostat.
33. SafetyControl:High-temperature-limitcutoffdeviceorsystem.
34. ReliefValve:ASMEratedandstampedforcombinationtemperature-and-pressurereliefvalves.Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
35. Residential, Collector-to-Tank-Coil, Solar, Electric, Domestic-Water Heaters:
36. <Double click here to find, evaluate, and insert list of manufacturers and products.>
37. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
38. Standard: UL 174 with integral coil-type heat exchanger.
39. Storage-Tank Construction: Steel.
40. Tappings: ASME B1.20.1 pipe thread.
41. Pressure Rating: 150 psig (1035 kPa).
42. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
43. Factory-Installed, Storage-Tank Appurtenances:
44. Anode Rod: Replaceable magnesium.
45. Dip Tube: Required unless cold-water inlet is near bottom of tank.
46. Drain Valve: Corrosion-resistant metal with hose-end connection.
47. Insulation: Comply with [ASHRAE/IES 90.1] [ASHRAE 90.2].
48. Jacket: Steel withenameled finish or high-impact composite material.
49. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
50. Heat Exchanger: Corrosion-resistant-metal immersion coil.
51. HeatingElement:Electric,screw-inimmersiontype.
52. TemperatureControl:Adjustablethermostat.
53. SafetyControl:High-temperature-limitcutoffdeviceorsystem.
54. ReliefValve:ASMEratedandstampedforcombinationtemperature-and-pressurereliefvalves.Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
55. Residential, Electric, Storage, Domestic-Water Heaters:
56. <Double click here to find, evaluate, and insert list of manufacturers and products.>
57. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
58. Standard: UL 174.
59. Storage-Tank Construction: Steel.
60. Tappings: ASME B1.20.1 pipe thread.
61. Pressure Rating: 150 psig (1035 kPa).
62. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
63. Factory-Installed, Storage-Tank Appurtenances:
64. Anode Rod: Replaceable magnesium.
65. Dip Tube: Required unless cold-water inlet is near bottom of tank.
66. Drain Valve: Corrosion-resistant metal with hose-end connection.
67. Insulation: Comply with [ASHRAE/IES 90.1] [ASHRAE 90.2].
68. Jacket: Steel, cylindrical, withenameled finish or high-impact composite material.
69. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
70. HeatingElements: Electric, screw-in immersion type.
71. TemperatureControl:Adjustablethermostat.
72. SafetyControl:High-temperature-limitcutoffdeviceorsystem.
73. ReliefValve:ASMEratedandstampedforcombinationtemperature-and-pressurereliefvalves.Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
74. Residential, Tabletop, Electric, Domestic-Water Heaters:
75. <Double click here to find, evaluate, and insert list of manufacturers and products.>

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS (continued):

76. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
77. Standard: UL 174.
78. Storage-Tank Construction: Steel.
79. Tappings: ASME B1.20.1 pipe thread.
80. Pressure Rating: 150 psig (1035 kPa).
81. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tapings.
82. Factory-Installed, Storage-Tank Appurtenances:
83. Anode Rod: Replaceable magnesium.
84. Dip Tube: Required unless cold-water inlet is near bottom of tank.
85. Drain Valve: Corrosion-resistant metal with hose-end connection.
86. Insulation: Comply with [ASHRAE/IES 90.1] [ASHRAE 90.2].
87. Jacket: Steel, rectangular, with flat-top work surface, raised back, and enamel finish.
88. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
89. Heating Elements: Electric, screw-in immersion type.
90. Temperature Control: Adjustable thermostat.
91. Safety Control: High-temperature-limit cutoff device or system.
92. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than working pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
93. Capacity and Characteristics:
94. Capacity: <Insert gal. (L)>.
95. Recovery: <Insert gph (L/s)> at [100 deg F (56 deg C)] <Insert temperature> temperature rise.
96. Temperature Setting: [125 deg F (52 deg C)] <Insert temperature>.
97. Power Demand: <Insert kilowatts>.
98. Heating Elements: <Insert kilowatts>.
99. Electrical Characteristics:
100. Volts: [120] [240] <Insert value> V.
101. Phases: [Single] [Three].
102. Hertz: 60 Hz.
103. Full-Load Amperes: <Insert value> A.
104. Minimum Circuit Ampacity: <Insert value> A.
105. Maximum Overcurrent Protection: <Insert value> A.

2.03 CDOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Expansion Tanks:

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. **A. O. Smith Corporation.**
 - b. **AMTROL, Inc.**
 - c. **State Industries.**
 - d. **Taco Comfort Solutions.**
2. Source Limitations: Obtain domestic-water expansion tanks from single source from single manufacturer.
3. Description: Steel pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
4. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS (continued):

- b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
 - 5. Capacity and Characteristics:
 - a. Working-Pressure Rating: 150 psig (1035 kPa).
 - b. Capacity Acceptable: 2 gal. (7.6 L) minimum.
 - c. Air Precharge Pressure: 40 psig (275 kPa).
 - B. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads.
 - C. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1.
 - D. Heat-Trap Fittings: ASHRAE/IES 90.1.
 - E. 220523.13"Butterfly ValvesforPlumbingPiping,"andSection220523.15"GateValvesforPlumbingPiping."
 - F. ComplywithrequirementsforbalancingvalvesspecifiedinSection221119"DomesticWaterPipingSpecialties."
 - G. Pressure-ReducingValves:ASSE1003forwater.Setat25-psig-(172.5-kPa-)maximumoutletpressureunlessotherwiseindicated.
 - H. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.
 - I. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
 - J. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.
 - K. Domestic-Water Heater Suspended Platform:
 - 1. Basis of Design: Holdrite QuickStand 50-SWHP-WM or Approved Equal.
 - 2. Corrosion-resistant metal platform not less than the base of the water heater for wall mounting, capable of supporting domestic-water heater and water. Platform shall have raised edge and NPS 1 metal drain fitting with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads to serve as a drain pan.
- 2.04 **SOURCE QUALITY CONTROL**
- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.
 - B. Hydrostatically test domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
 - C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.
 - D. Prepare test and inspection reports.

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS (continued):

PART 3 - EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Division 03.
 - 1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
 - 2. Maintain manufacturer's recommended clearances.
 - 3. Arrange units so controls and devices that require servicing are accessible.
- B. Install electric, domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
 - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.13 "Butterfly Valves for Plumbing Piping."
- C. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- D. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
- E. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- F. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
- G. Fill electric, domestic-water heaters with water.
- H. Charge domestic-water expansion tanks with air to required system pressure.
- I. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

3.02 PIPING CONNECTIONS

- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS (continued):

3.03 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.05 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain electric, domestic-water heaters.

END OF SECTION 223300

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Water closets.

1.03 DEFINITIONS

- A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.
- B. Remote Water Closet: Located more than 30 feet (9.1 m) from other drain line connections or fixture and where less than 1.5 drainage fixture units are upstream of the drain line connection.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
 - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flush-o-meter valves and electronic sensors to include in operation and maintenance manuals.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.
- B. Examine walls and floors for suitable conditions where water closets will be installed.

SECTION 224213.13 - COMMERCIAL WATER CLOSETS (continued):

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.

B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.

C. Install toilet seats on water closets.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Division 07 "Joint Sealant".

3.03 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.04 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

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SECTION 224213.13 - COMMERCIAL WATER CLOSETS (continued):

3.05 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

SECTION 224216.13 - COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
 - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Servicing and adjustments of automatic faucets.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
 - 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.01 LAVATORY SUPPORTS

- A. Wall Mounted Lavatories

SECTION 224216.13 - COMMERCIAL LAVATORIES (continued):

1. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier with rectangular, steel uprights.

2.02 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: cross handle.
- F. Risers:
 1. **NPS 1/2 (DN 15).**
 2. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

2.03 SUPPORTS

- A. Type II Lavatory Carrier:
 1. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

SECTION 224216.13 - COMMERCIAL LAVATORIES (continued):

- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 "Joint Sealants".
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.03 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.05 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.13

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SECTION 224216.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Service sinks.
 - 2. Supply fittings.
 - 3. Grout

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
 - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sinks to include in maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
 - 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

SECTION 224216.16 - COMMERCIAL SINKS (continued):

PART 2 - PRODUCTS

2.01 SERVICE SINKS

1. Support: ASME A112.6.1M, Type II sink carrier.

2.02 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- C. Operation: Cross handle.
- D. Risers:
 1. ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

2.03 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Non-shrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
- B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install sinks level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-hung sinks.

SECTION 224216.16 - COMMERCIAL SINKS (continued):

- C. Install accessible wall-mounted sinks at handicapped / elderly mounting height according to ICC/ANSI A117.1.
- D. Set floor-mounted sinks in leveling bed of cement grout.
- E. Install water-supply piping with stop on each supply to each sink faucet.
 - 1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
 - 2. Install stops in locations where they can be easily reached for operation.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 "Joint Sealants".
- H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.03 CONNECTIONS

- A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.05 CLEANING AND PROTECTION

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.
- D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16

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SECTION 224716 - PRESSURE WATER COOLERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes pressure water coolers and related components.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of pressure water cooler.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For pressure water coolers to include in maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Furnish 1 extra filter per water cooler.

PART 2 - PRODUCTS

2.01 SUPPORTS

- A. Type I Water Cooler Carrier:
 - 1. Standard: ASME A112.6.1M.
- B. Type II Water Cooler Carrier:
 - 1. Standard: ASME A112.6.1M.

SECTION 224716 - PRESSURE WATER COOLERS (continued):

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls and floors for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- B. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.
- C. Install mounting frames, affixed to building construction, and attach recessed, pressure water coolers to mounting frames.
- D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
- E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- G. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 "Joint Sealants."

3.03 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Install ball or gate shutoff valve on water supply to each fixture. **Install valve upstream from filter for water cooler.** Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
- D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

SECTION 224716 - PRESSURE WATER COOLERS (continued):

3.04 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust pressure water-cooler temperature settings.

3.05 CLEANING

- A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.
- C. Provide protective covering for installed fixtures.
- D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224716

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SECTION 230100 - GENERAL PROVISIONS FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Provisions of this Section apply to all Division 23 Specification Sections.

1.02 SUMMARY

- A. Section includes basic requirements for heating, ventilation, and air-conditioning systems.

1.03 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. Furnish: Supply and deliver to project site, ready for subsequent requirements.
- C. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.
- D. Provide: Furnish and install, complete and ready for intended use.
- E. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- F. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.
- G. Concealed Work: Work hidden from view, including inside chases, furred spaces, **or above ceilings**.
- H. Exposed Work: Work open to view, including inside mechanical and equipment rooms.

1.04 QUALITY ASSURANCE

- A. General:
 - 1. It is the intent of the plans and specifications to obtain a complete, operable and satisfactory installation.
 - 2. All materials shall be new, be properly labeled and/or identified and be in full compliance with the contract documents.
 - 3. All work shall comply with applicable Codes and Standards.

SECTION 230100 - GENERAL PROVISIONS FOR HVAC (continued):

- 4. Manufacturer's model names and numbers used in these specifications are subject to change per manufacturer's action. Contractor shall therefore verify them with manufacturer's representative before ordering any product or equipment
- B. Furnish new and unused materials and equipment manufactured in the U.S.A. Where two or more units of the same type or class of equipment are required provide units of a single manufacturer.

1.05 CODES AND STANDARDS

- A. Perform work in accordance with the following codes and any applicable statutes, ordinances, codes, and regulations of governmental authorities having jurisdiction.
 - 1. ASHRAE
 - a. Standard 90.1 Energy Standard for Buildings Except Low Rise Residential Buildings
 - 2. Occupational Safety and Health Regulations (OSHA).
 - 3. National Fire Codes
 - a. NFPA 1 Uniform Fire Code – 2021 (Florida Edition)
 - b. NFPA 70 National Electrical Code – 2020
 - c. NFPA 101 Life Safety Code – 2021 (Florida Edition)
 - 4. Florida Building Code, 2023 Edition
 - a. Building Code
 - b. Existing Building Code
 - c. Energy Conservation Code
 - d. Mechanical Code
 - e. Plumbing Code
 - f. Fuel Gas Code
 - g. Accessibility Code
 - 5. 2023 ICC 500 (FEMA 361 5th Edition)
 - a. Chapter 1 Application And Administration
 - b. Chapter 6 Fire Safety
 - c. Chapter 7 Essential Features And Accessories
 - d. Chapter 8 Test Methods For Impact And Pressure Testing
 - 6. Florida Statutes
 - a. Chapter 471 Engineering
 - b. Chapter 533.80 Building Construction Standards; Florida Building Code - Enforcement
 - 7. Florida Administrative Code
 - a. Chapter 61G15-34 Responsibility Rules of Professional Engineers Concerning the Design of Mechanical Systems
 - b. Chapter 69A-3 Fire Prevention – General Provisions
 - c. Chapter 69A-60 The Florida Fire Prevention Code
- B. Resolve, in writing, any code violation discovered in contract documents with the Engineer prior to bidding. After award of the contract, make any correction or addition necessary for compliance with applicable codes at no additional cost to Owner.

SECTION 230100 - GENERAL PROVISIONS FOR HVAC (continued):

- C. The Contractor shall include in the Work, without extra cost to the Owner, any labor, materials, services, apparatus, and drawings required to comply with all applicable laws, ordinances, rules, and regulations.
- D. Where there is conflict between the Contract Documents and the applicable Codes, the Codes shall govern, except where the requirements of the Contract Documents are more stringent.

1.06 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments, or supplements in effect on date bids are received. Specifications and standards are minimum requirements for all equipment, material and work. In instances where capacities, size or other feature of equipment, devices or materials exceed these minimums, meet listed or shown capacities.
- B. Whenever a reference is made to a standard, installation and materials shall comply with the latest published edition of the standard at the time project is bid unless otherwise specified herein

1.07 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.

1.08 PERMITS FEES AND INSPECTIONS

- A. Obtain and pay for all permits, fees, tap fees, connection charges, demand charges, systems charges, impact fees, and inspections.
- B. Deliver all certificates of inspection issued by authorities having jurisdiction to the Engineer.

1.09 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for direction before proceeding.
 - 1. If discrepancies or conflicts occur between drawings, or between drawings and specifications, notify the Engineer in writing prior to bid date; however, the most stringent requirement shall govern.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.10 SUBMITTALS

SECTION 230100 - GENERAL PROVISIONS FOR HVAC (continued):

- A. Submittals (including Product Data, Shop Drawings, and any other Action Submittal or Information Submittal) will only be reviewed if they are submitted in full accordance with the General and Supplementary Conditions, Division 01, and the following:
1. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are approved by the Engineer.
 3. Submittals shall only contain relevant product data. Remove or strikeout irrelevant product data.
 4. Prepare submittals as PDF electronic files and electronically transmit to Engineer through email or web-based project software site, in accordance with Division 01 Specification Sections. Submittals shall be in searchable PDF format and not a scanned copy.
 5. Options: Identify options requiring selection by Engineer.
 6. Deviations: Clearly identify deviations from requirements in the Contract Documents, including minor variations and limitations.
 7. Revisions: Include relevant additional information and revisions, other than those specifically requested by Engineer on previous submittals. Indicate by highlighting on each submittal or noting on attached submittal sheet.
 8. Contractor's Review:
 - a. Submittals shall have been reviewed and approved by the General Contractor / Construction Manager. Include approval stamp, 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.
 - b. Engineer will not review submittals received from Contractor that do not have Contractor's review and approval.
 9. Electrical Modifications:
 - a. The electrical design indicated on the plans supports the Basis of Design specifications for the HVAC systems at the time of design.
 - b. If HVAC equipment is submitted with different electrical requirements, it is the responsibility of the Contractor to resolve all required electrical design changes, including, but not limited to: wire and conduit size, type or size of disconnect or overload protection, breaker coordination, point(s) of connection, etc. Any corrections required shall be provided at no additional cost.
 - c. Submittal shall clearly show the electrical design revisions with a written statement that this change will be provided at no additional cost. Submittals made with no written reference to the electrical design revisions will be presumed to work with the electrical design.
- B. Processing Time: Allow 15 days for submittal review. Time of review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of the failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. The Contractor shall not be relieved of responsibility for deviations from requirements of the contract documents by the Engineer's approval of shop drawings, product data, samples, or similar submittals unless the Contractor has specifically informed the Engineer in writing of such deviation at the time of submittal, and the Engineer has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in shop drawings, product data, samples, or similar submittals by the Engineer's approval thereof.

SECTION 230100 - GENERAL PROVISIONS FOR HVAC (continued):

- D. Submittals on any particular phase of Work will receive only one review and one re-review (if required). If additional reviews are required beyond these two, the Contractor will be charged \$120.00 per hour for review time. This fee shall be paid to the Engineer prior to Submittal release.

1.11 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
 - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, fire protection, mechanical, electrical, and communication systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, pull boxes, junction boxes, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 - 1. Floor Plans: Show architectural and structural elements, and Work associated with Divisions 21 through 29, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved. Supplement plan drawings with section drawings where required to adequately represent the Work.
 - a. Mechanical Systems (Divisions 21, 22, 23, 25):
 - 1) Sizes and bottom elevations of ductwork and piping runs, including insulation, heat tracing, bracing, flanges, and support systems. Indicate proposed changes to layout.
 - 2) Locations and sizes of major equipment and components.
 - 3) Fire-rated enclosures around ductwork.
 - 4) Structural members to which ductwork and piping will be attached or suspended from.
 - b. Electrical and Communication Systems (Divisions 25, 26, 27, 28, 29):
 - 1) Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.

SECTION 230100 - GENERAL PROVISIONS FOR HVAC (continued):

- 2) Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - 3) Panel board, switch board, switchgear, transformer, busway, generator, and motor-control center locations.
 - 4) Location of pull boxes and junction boxes, dimensioned from column center lines.
 - 5) Structural members to which luminaire and equipment will be attached or suspended from.
 - 6) Lightning protection system components attaching to or penetrating through the roofing and moisture protection systems, coordinated with the roofing system manufacturer.
 - 7) Cable tray layout, offsets, transitions, clearances, elevations, and relationships between components and adjacent structural, mechanical and electrical elements.
 2. Reflected Ceiling Plans: Show locations of visible devices mounted to, suspended from, or penetrating through the ceiling, relative to the finished ceiling, including the following:
 - a. Fire suppression sprinklers and nozzles.
 - b. Air outlets and inlets.
 - c. Luminaires (Lighting fixtures).
 - d. Lighting control devices.
 - e. Speakers.
 - f. Ceiling-mounted projectors.
 - g. Access control devices.
 - h. Video surveillance devices.
 - i. Fire alarm devices.
 - j. Access panels.
 - k. Perimeter moldings.
 - l. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the ceiling.
 3. Plenum Space: Indicate subframing for support of ceiling and wall systems, equipment for Divisions 21 through 29, and related Work. Locate components within plenums to accommodate layout of components indicated on Drawings for Divisions 21 through 29. Indicate areas of conflict between components of Divisions 21 through 29.
 4. Equipment Rooms: Provide coordination drawings for equipment rooms showing plans and elevations of equipment for Divisions 21 through 29.
 5. Penetrations: Indicate locations of penetrations and openings in structural components, smoke barriers, and fire-rated construction.
 6. Review: Engineer will review coordination drawings to confirm that in general the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Engineer determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Engineer will so inform Contractor, who shall make suitable modifications and resubmit.
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Submittal Format: Submit or post coordination drawing files using PDF format.
 2. BIM File Incorporation: Develop and incorporate coordination drawing files into BIM established for Project.
 - a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Engineer.

SECTION 230100 - GENERAL PROVISIONS FOR HVAC (continued):

3. Engineer will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
 - a. Engineer makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Engineer.

1.12 SUBSTITUTIONS

- A. By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.
- B. Substitution Requests shall include, at a minimum:
 1. Statement indicating why specified material, equipment, or installation method cannot be provided, if applicable.
 2. Coordination of information, including a list of changes and 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.
 3. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include an 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.
 4. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 5. 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.
 6. Cost information, including a proposal of change, if any, in the Contract Sum.
 7. 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.
 8. 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.
- C. Procurement Substitution Requests submitted prior to receipt of bids will be received and considered by Owner when the following conditions are satisfied, as determined by Engineer; otherwise, requests will be returned without action:
 1. Requests for substitution of materials and equipment are received no later than 10 days prior to date of bid opening.
 2. Extensive revisions to the Contract Documents are not required.
 3. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.
 4. The request is fully documented and properly submitted.
- D. Substitutions for Cause, as required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms will be received and considered by

SECTION 230100 - GENERAL PROVISIONS FOR HVAC (continued):

Engineer, only when the following conditions are satisfied; otherwise, requests will be returned without action, except to record noncompliance with these requirements:

1. Requested substitution is consistent with the Contract Documents and will produce indicated results.
2. Substitution request is fully documented and properly submitted.
3. Requested substitution has received necessary approvals of authorities having jurisdiction.
4. Requested substitution is compatible with other portions of the Work.
5. Requested substitution has been coordinated with other portions of the Work.
6. Requested substitution provides specified warranty.
7. 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.

E. Substitutions for Convenience, not required in order to meet other Project requirements but may offer advantage to Contractor or Owner, will be received and considered by Owner, as determined by Engineer, only when the following conditions are satisfied; otherwise, requests will be returned without action, except to record noncompliance with these requirements:

1. Requested substitution is received within 60 days after the Notice of Award.
2. 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 Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
3. Requested substitution does not require extensive revisions to the Contract Documents.
4. Requested substitution is consistent with the Contract Documents and will produce indicated results.
5. Substitution request is fully documented and properly submitted.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. 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.

F. If a requested substitution is approved but contains differences or omissions not specifically identified to the attention of the Engineer in the substitution request, the Owner reserves the right to require equal or similar features to be added to the substituted products or to have the substituted products replaced at the Contractor's expense.

1.13 PROJECT RECORD DOCUMENTS

A. Recording: Maintain one copy of the Contract Documents and Shop Drawings during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Preparation:

1. Contract Drawings and Shop Drawings:
 - a. Mark revisions to show where the actual installation varies from that shown originally.
 - b. Mark record sets completely and accurately, including important information that was either shown schematically or omitted from original Drawings.

SECTION 230100 - GENERAL PROVISIONS FOR HVAC (continued):

- c. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - d. Record underground and under-slab piping installed, dimensioning exact location and elevation of piping.
- 2. Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
- 3. Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
- C. Deliver: Prior to Final Completion, provide record documents to Owner as indicated below:
 - 1. Record Drawings: Submit PDF electronic files of scanned record prints and one set of prints.
 - 2. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
 - 3. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
 - 4. Miscellaneous Record Submittals: Submit annotated PDF electronic files directories of each submittal.

1.14 OPERATION AND MAINTENANCE MANUALS

- A. Prepare and submit a comprehensive manual of emergency, operation, and maintenance data and materials in full accordance with the General and Supplementary Conditions, Division 01, and the following:
 - 1. Operations and Maintenance Manuals: Assemble a complete set of data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system, including:
 - a. Information required for daily operation and management, operating standards, and routine and special operating procedures.
 - b. Manufacturers' maintenance documentation, preventative maintenance procedures and frequency, repair procedures, wiring and systems diagrams, list of spare parts, and warranty information.
 - 2. Submit manuals as PDF electronic files and electronically transmit to Engineer through email or web-based project software site, in accordance with Division 01 Specification Sections. Submittals shall be in searchable PDF format and not a scanned copy.

1.15 DEMONSTRATION AND TRAINING

- A. Prepare and provide services of qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not a part of a system in accordance with the General and Supplementary Conditions, Division 01, individual Specification Sections, and the following:
 - 1. Demonstration and training shall occur upon completion of the Work and at a time designated by the Owner's representative.
 - 2. Provide a high-resolution, digital video recording of each training session to the Owner.

1.16 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.

SECTION 230100 - GENERAL PROVISIONS FOR HVAC (continued):

- B. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

1.17 WARRANTY

- A. Warranty work and equipment within specified warranty period. During the warranty period, provide labor and materials to make good any faults or imperfections that may arise due to defects or omissions in materials or workmanship without expense to the Owner.
 - 1. Warranty Period: One year from date of Substantial Completion.
- B. 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 Contract Documents.
- C. Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond nor relieving the Contractor of responsibilities during the warranty period.

PART 2 - PRODUCTS (NONE)

PART 3 - EXECUTION

3.01 CONTRACT DOCUMENTS

- A. Examine all drawings and specifications carefully before submitting a bid. **Architectural drawings take precedence over mechanical or electrical drawings with reference to building construction.**
- B. For purposes of clearness and legibility, drawings are essentially diagrammatic and, although size and location of equipment are drawn to scale wherever possible, Contractor shall make use of all data in all of the contract documents and shall verify this information at the building site.
- C. The drawings indicate required size and points of termination of pipes, conduits, and ducts and suggest proper routes to conform to structure avoid obstructions and preserve clearances. However, it is not intended that drawings indicate all necessary offsets, and it shall be the responsibility of the Contractor to make the installation in such a manner as to conform to structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further instructions or cost to the Owner.
- D. Furnish, install and/or connect with appropriate services all items shown on any drawing without additional compensation.
- E. Any and all questions about a subcontractor's scope of work responsibility shall be addressed to and answered by the General Contractor / Construction Manager.
- F. Questions About Construction Documents: Any and all questions shall be submitted through the proper channels IN WRITING and, in turn, shall be answered by the Engineer in writing. All telephone conversations shall be considered unofficial and, as such, shall not be considered official or binding responses to Contractor's questions.
- G. Drawings, specifications, or other documents issued by the Engineer in electronic format and/or electronic media are provided for convenience only and are not intended for use as Contract Documents.

SECTION 230100 - GENERAL PROVISIONS FOR HVAC (continued):

1. The electronic files are provided merely as a convenience to the Recipient.
2. The electronic files do not replace or supplement the paper copies of any drawings, specifications, or other documents included in the Contract Documents for use on the project.
3. The Engineer makes no representation, warranty, or guarantee that electronic files:
 - a. Are suitable for any other usage or purpose.
 - b. Have any particular durability.
 - c. Will not damage or impair the Recipient's computer or software.
 - d. Contain no errors or mechanical flaws or other discrepancies that may render them unsuitable for the purpose intended by the Recipient.
4. Due to the unsecured nature of the electronic files and the inability of Engineer or the Recipient to establish controls over their use, the Engineer assumes no responsibility for any consequences arising out of the use of the data. It is the sole responsibility of the Recipient to check the validity of all information contained therein. The Recipient shall at all times refer to the signed and sealed drawings, specification or other documents for the project during all phases of the project. The Recipient shall assume all risks and liabilities resulting from the use of the electronic files.

3.02 SUPERVISION OF WORK

- A. Perform all work under the direct supervision of an experienced, qualified superintendent. The Engineer has the right to remove a superintendent who, in the Engineer's opinion, is not satisfactory.

3.03 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, mechanical and electrical systems, and other construction affecting the Work.
- 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.
 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. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.04 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, 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

SECTION 230100 - GENERAL PROVISIONS FOR HVAC (continued):

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 caused by differing field conditions outside the control of Contractor, submit a request for information to Engineer.
- E. Interruption of Service: Before any existing equipment or system is shut down for disconnecting or tie-ins, coordinate with Engineer and Owner regarding acceptable dates and times for this Work to be performed. Work shall be performed at the time best suited for the Owner, which typically is either on weekends, holidays, and/or after normal working hours. Services shall be restored the same day unless prior arrangements are made. All overtime or premium costs associated with this Work shall be included in the Contractor's bid.

3.05 INSTALLATION

- A. Install materials and equipment in a professional manner. The Engineer may direct replacement of items which, in the Engineer's opinion, do not present a professional appearance or do not allow adequate space for maintenance. Replace or reinstall items at the expense of the Contractor.
- B. General: 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 (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.
- C. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- D. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- E. 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.
- F. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- G. Obstructions
 - 1. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
 - 2. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided. Verify locations given.

SECTION 230100 - GENERAL PROVISIONS FOR HVAC (continued):

3. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
 4. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.
- H. Where "rated" walls, floor, roofs and ceilings are penetrated or cut to install equipment, materials, devices, etc. the Contractor shall provide and install all materials required to re-establish the rating of the wall, floor, roof, or ceiling to the satisfaction of the authority having jurisdiction.
- I. Structural Elements: Do not cut structural elements without written approval from Engineer. Notify Engineer of locations and details of cutting and await directions from Engineer before proceeding. If approved by Engineer:
1. Shore, brace, and support structural elements during cutting and patching.
 2. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
- J. Space Requirements: Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material which is not suitable in this respect.
- K. Tools and Equipment: Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions without cost to the Owner.
- L. Phasing: Provide all temporary valves, piping, ductwork, equipment, and devices as required. Maintain temporary services to areas as required. Remove all temporary material and equipment on completion of work unless Engineer concurs that such material and equipment would be beneficial to the Owner on a permanent basis.

3.06 OWNER-INSTALLED PRODUCTS

- A. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

3.07 PROTECTION OF EXISTING FINISHES, CARPET, AND FURNISHING

- A. Protect existing finishes, carpet, casework, furnishing, and other building components against damage and soiling throughout construction activities. Take care during construction not to damage existing items. Contractor shall be responsible for replacing damaged material or restoring damaged materials to the Owner's satisfaction.
- B. When permitted by Engineer, items may be removed to a suitable, protected storage location during construction and cleaned and reinstalled in their original locations after construction operations are complete.
- C. Furniture may be relocated during construction and reinstalled in their original locations after construction operations are complete.
- D. Means and methods for protection are the responsibility of the Contractor. Utilize plywood, polyethylene sheeting, dust cloths, and other means as required.

SECTION 230100 - GENERAL PROVISIONS FOR HVAC (continued):

3.08 UTILITY SERVICES AND MECHANICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. Arrange to shut off utilities with utility companies.
 - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 4. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.09 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Structural Elements: When cutting and patching structural elements, notify Engineer of locations and details of cutting and await directions from Engineer before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

SECTION 230100 - GENERAL PROVISIONS FOR HVAC (continued):

- F. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
- G. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety.
- H. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- I. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- J. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable or with in-place materials.
 - 1. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 2. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials.
- K. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.10 PAINTING

- A. Comply with requirements with General and Supplementary Conditions, Division 01, Division 09, and individual Specification Sections.
- B. Touch-up factory finishes on equipment provided under Division 23. Obtain matched color coatings from the manufacturer and apply as directed. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint, as required.

SECTION 230100 - GENERAL PROVISIONS FOR HVAC (continued):

- C. Paint the following work where exposed to view:
 - 1. Uninsulated Metal Piping (bare copper piping not required to be painted unless noted otherwise):
 - a. Natural or LP Gas: Yellow
 - b. Condenser Water: Green
 - c. Other: To be determined by Engineer
 - 2. Uninsulated plastic piping
 - 3. Tanks that do not have factory-applied final finishes.
 - 4. Duct, equipment, and pipe insulation having a cotton or canvas insulation covering or other paintable jacket material, as outlined in individual Specification Sections.
- D. Paint the following work where exposed in occupied spaces:
 - 1. Duct, equipment, and pipe insulation having a cotton or canvas insulation covering or other paintable jacket material, as outlined in individual Specification Sections.
 - 2. Other items as directed by Engineer.
- E. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.11 REPAIR OF WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 2. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

3.12 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Furnish a letter from the control manufacturer stating that all controls have been checked for operation and calibration, and the system is operating as designed.
- C. Furnish a letter from an authorized factory representative of the air conditioning unit manufacturer stating that the complete refrigeration installation including pipe sizing and routing and operating and safety controls has been checked and is operating properly.

SECTION 230100 - GENERAL PROVISIONS FOR HVAC (continued):

D. Tests

1. Include all tests specified and/or required under laws, rules and regulations of all departments having jurisdiction. Tests shall also be performed as indicated herein and other sections of the specifications.
2. After all systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation. Make adjustments as required to ensure proper functioning of all systems.
3. All parts of the work and associated equipment shall be tested and adjusted to work properly and be left in perfect operating condition.
4. Correct defects disclosed by these tests without any additional cost to the Owner. Repeat tests on repaired or replaced work.
5. Maintain a log of all tests being conducted and have it available for review by the Engineer. Log to indicate date, type of tests, duration, and defects noted and when corrected.
6. Special tests on individual systems are specified under individual Specification Sections.

- E. 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.

3.13 CLEANING

- A. Progress Cleaning: 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 (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

- B. Final 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. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - b. Remove labels that are not permanent.
 - c. Wipe surfaces of equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

3.14 MAINTENANCE SERVICE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of systems and equipment Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

END OF SECTION 230100

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SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.03 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

2.02 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT (continued):

- B. Efficiency: Premium efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Power factor: 0.80.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Re-greasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F.
- I. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable-Frequency Controllers:
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.05 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
- B. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- C. Motors 1/20 HP and Smaller: Shaded-pole type.
- D. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT (continued):

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

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SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Grout.
 - 3. Silicone sealants.
- B. Related Requirements:
 - 1. Division 07 for penetration Firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.03 ACTION SUBMITTALS

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

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.01 SLEEVES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.02 GROUT

- A. Description: Non-shrink, recommended for interior and exterior sealing openings in nonfire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING (continued):

- D. Packaging: Premixed and factory packaged.

2.03 SILICONE SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, non-sag, plus 25 percent and minus 25 percent movement capability, non-traffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, use NT.
 - 1. Sealant shall have a VOC content of 250 g/L or less.
- B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and non-traffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.
 - 1. Sealant shall have a VOC content of 250 g/L or less.
- C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
 - 1. Sealant shall have a VOC content of 250 g/L or less.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use sealants appropriate for size, depth, and location of joint.

3.02 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls Above Grade:

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING (continued):

- a. Piping Smaller Than **NPS 6** (DN 150): Steel pipe sleeves.

END OF SECTION 230517

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SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.

1.03 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and polished brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished, chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
 - b. Insulated Piping: One-piece stamped steel with polished, chrome-plated finish.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.

SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING (continued):

- d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.
- e. Bare Piping in Unfinished Service Spaces: One-piece cast brass with rough-brass finish.
- f. Bare Piping in Equipment Rooms: One-piece cast brass with rough-brass finish.

3.02 **FIELD QUALITY CONTROL**

- A. Using new materials, replace broken and damaged escutcheons.

END OF SECTION 230518

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Fastener systems.
 - 5. Equipment supports.
- B. Related Requirements:
 - 1. Section 230548.13 "Vibration Controls for HVAC" for vibration isolation devices.
 - 2. Section 233113 "Metal Ducts" for duct hangers and supports.

1.03 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
 - 3. Equipment supports.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT (continued):

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

2.02 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-plated steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-plated steel.

2.03 TRAPEZE PIPE HANGERS

- #### **A.**
- Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.04 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. [Cooper B-Line, Inc.](#)
 - b. [Flex-Strut Inc.](#)
 - c. [Unistrut Corporation](#); Tyco International, Ltd.
2. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel channel with intumed lips.
5. Channel Width: Selected for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
8. Metallic Coating: Electroplated zinc indoors and Hot-dip galvanized outdoors.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT (continued):

3. Channels: Continuous slotted carbon-steel channel with intumed lips.
4. Channel Width: Select for applicable load criteria.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Hot-dip galvanized.

2.05 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.06 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.07 MATERIALS

- A. Aluminum: **ASTM B 221** (**ASTM B 221M**).
- B. Carbon Steel: ASTM A 1011 / A 1011M.
- C. Structural Steel: ASTM A 36 / A 36M, carbon-steel plates, shapes, and bars; galvanized.
- D. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.
- E. Grout: ASTM C 1107 / C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
 1. Properties: Non-staining, noncorrosive, and nongaseous.
 2. Design Mix: **5000-psi** (**34.5-MPa**), 28-day compressive strength.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Comply with requirements in Division 07 for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus **200 lb** (**90 kg**).

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT (continued):

3.02 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36 / A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1 / D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT (continued):

1. Install MSS SP-58, Type 40, protective shields on piping. Shields shall span an arc of 180 degrees. Secure shield to pipe on both ends with stainless steel bands.
2. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 - d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
 - e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

3.03 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.04 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 / D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.05 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT (continued):

3.06 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Comply with requirements in Division 09 for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780 / A 780M.

3.07 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
- K. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT (continued):

- L. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

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SECTION 230548.13 - VIBRATION CONTROLS FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Elastomeric isolation pads.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.

PART 2 - PRODUCTS

2.01 ELASTOMERIC ISOLATION PADS

- A. Elastomeric Isolation Pads:
 - 1. **Basis-of-Design Product:** Subject to compliance with requirements, provide Mason Industries, Inc.; Mason Super W or comparable product by one of the following:
 - a. **Kinetics Noise Control, Inc.**
 - b. **Vibration Mountings & Controls, Inc.**
 - 2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
 - 3. Size: Factory or field cut to match requirements of supported equipment.
 - 4. Pad Material: Oil and water resistant with elastomeric properties.
 - 5. Surface Pattern: Waffle pattern.

SECTION 230548.13 - VIBRATION CONTROLS FOR HVAC (continued):

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 VIBRATION CONTROL DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Division 03 "Cast-in-Place Concrete".
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

3.03 VIBRATION ISOLATION EQUIPMENT BASES INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Division 03 "Cast-in-Place Concrete".

END OF SECTION 230548.13

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Pipe labels.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: White.
 - 3. Background Color: Black.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 - 6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT (continued):

- B. Label Content: Include equipment's Drawing designation or unique equipment number.
- C. Equipment Label Schedule: For each item of equipment to be labeled, tabulate equipment label information. Equipment schedule shall be included in operation and maintenance data.

2.02 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: Size letters according to ASME A13.1 for piping.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.03 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.04 PIPE LABEL INSTALLATION

- A. **099123 "Interior Painting."][Section 099600 "High-Performance Coatings."]**
- B. **Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, [with painted, color-coded bands or rectangles] on each piping system.**

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT (continued):

- C. Identification Paint:** Use for contrasting background.
- D. Stencil Paint:** Use for pipe marking.
- E. Pipe Label Locations:** Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of **50 feet (15 m)** along each run. Reduce intervals to **25 feet (7.6 m)** in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- F. Directional Flow Arrows:** Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions. Install marker tape with arrows around the entire circumference of the pipe at the beginning and end of the pipe-label content.
- G. Pipe Label Color Schedule:**
 - 1. Refrigerant Piping: Black letters on a safety-orange background.

END OF SECTION 230553

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SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - 2. Balancing steam systems.
 - 3. Testing, Adjusting, and Balancing Equipment:
 - a. Motors.
 - b. Heat-transfer coils.
 - 4. Testing, adjusting, and balancing existing systems and equipment.
 - 5. Sound tests.
 - 6. Vibration tests.
 - 7. Duct leakage tests.
 - 8. Control system verification.

1.03 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. BAS: Building automation systems.
- C. NEBB: National Environmental Balancing Bureau.
- D. TAB: Testing, adjusting, and balancing.
- E. TABB: Testing, Adjusting, and Balancing Bureau.
- F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- G. TDH: Total dynamic head.
- H. Special Inspector: An entity engaged to inspect smoke control systems.

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC (continued):

1.04 PREINSTALLATION MEETINGS

- A. TAB Conference: Conduct a TAB conference after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.
 - 1. Minimum Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Needs for coordination and cooperation of trades and subcontractors.
 - d. Proposed procedures for documentation and communication flow.

1.05 ACTION SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Report Format Submittals: Within 60 days of Contractor's Notice to Proceed, submit the following as specified in "Preparation" Article.
 - 1. TAB strategies and step-by-step procedures.
 - 2. System readiness checklists.

1.06 INFORMATIONAL SUBMITTALS

- A. Contract Documents Examination Report: Within 60 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- B. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- C. Certified TAB reports.
- D. Sample report forms.
- E. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.07 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by AABC or NEBB.
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC or NEBB. A TAB Field Supervisor shall be on the project site at all times during TAB work and shall have a minimum three years' of TAB experience with air, water, sound, and vibration testing.

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC (continued):

- a. NEBB: Certified Professional (TAB-CP) or Certified Technician (TAB-CT).
 - b. AABC: Certified Test and Balance Engineer (TBE) or Certified Technician.
- 2. TAB Technician: Employee of the TAB specialist and certified by AABC or NEBB as a TAB technician.
 - a. NEBB: Certified Technician (TAB-CT).
 - b. AABC: Certified Technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. [ASHRAE 62.1 Compliance](#): Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."
- E. Warranty: Comply with the program requirements of either:
 - 1. AABC National Performance Guaranty.
 - 2. NEBB Conformance Certification.

1.08 FIELD CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.09 TAB CONTRACTOR'S RESPONSIBILITIES

- A. Attend testing, adjusting, and balancing review and coordination meeting.
- B. Participate in verification of the TAB report by the CxA or Engineer for verification and diagnostic purposes.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 TAB SPECIALISTS

- A. Subject to compliance with requirements, engage one of the following:
 - 1. FTS Test and Balance
 - a. Location: Tallahassee, Florida
 - b. Contact: Heath Allbaugh, CP

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC (continued):

- c. Phone Number: (850) 727-5391
- 2. HVAC Testing Services, Inc.
 - a. Location: Thomasville, Georgia
 - b. Contact: Greg Lang, CP / Pete Lang
 - c. Phone Number: (229) 227-0255
- 3. Indoor Air Professionals, Inc.
 - a. Location: Fort Myers, Florida
 - b. Contact: Joseph Molloy, III, CP
 - c. Phone Number: (239) 707-9732
- 4. W.W. Gay Mechanical
 - a. Location: Jacksonville, Florida
 - b. Contact: Don Eshelman, CP
 - c. Phone Number: (904) 394-7298

3.02 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.
- K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC (continued):

- L. Examine operating safety interlocks and controls on HVAC equipment.
- M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.03 PREPARATION

- A. Prepare a TAB plan that includes the following:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Project specific forms with specific identification for all equipment and systems. Project specific forms shall include design data for all equipment and systems to be tested and descriptions of any other necessary supporting data required in the final report that will be included (i.e. fan/pump curves, layout drawings, balancing valve charts, etc).
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
 - b. Duct systems are complete with terminals installed.
 - c. Volume, smoke, and fire dampers are open and functional.
 - d. Clean filters are installed.
 - e. Fans are operating, free of vibration, and rotating in correct direction.
 - f. Automatic temperature-control systems are operational.
 - g. Ceilings are installed.
 - h. Windows and doors are installed.
 - i. Suitable access to balancing devices and equipment is provided.

3.04 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" , and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
 - 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC (continued):

3.05 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.06 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
 - 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report artificial loading of filters at the time static pressures are measured.
 - 3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC (continued):

4. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
 6. Determine and make appropriate modifications for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
1. Measure airflow of submain and branch ducts.
 2. Adjust submain and branch duct volume dampers for specified airflow.
 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
 2. Measure inlets and outlets airflow.
 3. Adjust each inlet and outlet for specified airflow.
 4. Re-measure each inlet and outlet after they have been adjusted.
- D. Verify final system conditions.
1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
 2. Re-measure and confirm that total airflow is within design.
 3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
 4. Mark all final settings.
 5. Test system in economizer mode. Verify proper operation and adjust if necessary.
 6. Measure and record all operating data.
 7. Record final fan-performance data.

3.07 PROCEDURES FOR MOTORS

- A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer's name, model number, and serial number.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Phase and hertz.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter size and thermal-protection-element rating.
 8. Service factor and frame size.
- B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.08 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC (continued):

- B. Measure entering- and leaving-air temperatures.
- C. Record fan and motor operating data.

3.09 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each electric heating coil:
 - 1. Nameplate data.
 - 2. Airflow.
 - 3. Entering- and leaving-air temperature at full load.
 - 4. Voltage and amperage input of each phase at full load.
 - 5. Calculated kilowatt at full load.
 - 6. Fuse or circuit-breaker rating for overload protection.
- B. Measure, adjust, and record the following data for each refrigerant coil:
 - 1. Dry-bulb temperature of entering and leaving air.
 - 2. Wet-bulb temperature of entering and leaving air.
 - 3. Airflow.
 - 4. Air pressure drop.

3.10 DUCT LEAKAGE TESTS

- A. Witness the duct pressure testing performed by Installer.
- B. Verify that proper test methods are used and that leakage rates are within specified tolerances.
- C. Report deficiencies observed.

3.11 CONTROLS VERIFICATION

- A. In conjunction with system balancing, perform the following:
 - 1. Verify temperature control system is operating within the design limitations.
 - 2. Confirm that the sequences of operation are in compliance with Contract Documents.
 - 3. Verify that controllers are calibrated and function as intended.
 - 4. Verify that controller set points are as indicated.
 - 5. Verify the operation of lockout or interlock systems.
 - 6. Verify the operation of valve and damper actuators.
 - 7. Verify that controlled devices are properly installed and connected to correct controller.
 - 8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
 - 9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.
- B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC (continued):

3.12 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 - 2. Air Outlets and Inlets: Plus or minus 10 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.13 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.14 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
 - 3. Certify validity and accuracy of field data.
 - 4. Include warranty certificate meeting the requirements of one of the following programs:
 - a. AABC – National Performance Guaranty
 - b. NEBB – Conformance Certification
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Fan curves, marked with operating conditions.
 - 2. Manufacturers' test data.
 - 3. Field test reports prepared by system and equipment installers.
 - 4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.
 - 2. Name and address of the TAB specialist.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC (continued):

9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Notes to explain why certain final data in the body of reports vary from indicated values.
 14. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Duct, outlet, and inlet sizes.
 3. Pipe and valve sizes and locations.
 4. Position of balancing devices.
 - 5.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches (mm), and bore.
 - i. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches (mm), and bore.
 - f. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC (continued):

3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in **cfm** (L/s).
 - b. Total system static pressure in **inches wg** (Pa).
 - c. Fan rpm.
 - d. Discharge static pressure in **inches wg** (Pa).
 - e. Filter static-pressure differential in **inches wg** (Pa).
 - f. Cooling-coil static-pressure differential in **inches wg** (Pa).
 - g. Heating-coil static-pressure differential in **inches wg** (Pa).
 - h. Outdoor airflow in **cfm** (L/s).
 - i. Return airflow in **cfm** (L/s).
 - j. Outdoor-air damper position.
 - k. Return-air damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:
 - a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in **fins per inch** (mm) o.c.
 - f. Make and model number.
 - g. Face area in **sq. ft.** (sq. m).
 - h. Tube size in **NPS** (DN).
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in **cfm** (L/s).
 - b. Average face velocity in **fpm** (m/s).
 - c. Air pressure drop in **inches wg** (Pa).
 - d. Outdoor-air, wet- and dry-bulb temperatures in **deg F** (deg C).
 - e. Return-air, wet- and dry-bulb temperatures in **deg F** (deg C).
 - f. Entering-air, wet- and dry-bulb temperatures in **deg F** (deg C).
 - g. Leaving-air, wet- and dry-bulb temperatures in **deg F** (deg C).
 - h. Refrigerant expansion valve and refrigerant types.
 - i. Refrigerant suction pressure in **psig** (kPa).
 - j. Refrigerant suction temperature in **deg F** (deg C).

G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Coil identification.
 - d. Capacity in **Btu/h** (kW).
 - e. Number of stages.
 - f. Connected volts, phase, and hertz.
 - g. Rated amperage.
 - h. Airflow rate in **cfm** (L/s).

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC (continued):

- i. Face area in **sq. ft.** (**sq. m**).
 - j. Minimum face velocity in **fpm** (**m/s**).
 - 2. Test Data (Indicated and Actual Values):
 - a. Heat output in **Btu/h** (**kW**).
 - b. Airflow rate in **cfm** (**L/s**).
 - c. Air velocity in **fpm** (**m/s**).
 - d. Entering-air temperature in **deg F** (**deg C**).
 - e. Leaving-air temperature in **deg F** (**deg C**).
 - f. Voltage at each connection.
 - g. Amperage for each phase.
- H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
- 1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in **inches** (**mm**), and bore.
 - h. Center-to-center dimensions of sheave and amount of adjustments in **inches** (**mm**).
 - 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in **inches** (**mm**), and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in **inches** (**mm**).
 - g. Number, make, and size of belts.
 - h. Belt tension in lbs.
 - 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in **cfm** (**L/s**).
 - b. Total system static pressure in **inches wg** (**Pa**).
 - c. Fan rpm.
 - d. Discharge static pressure in **inches wg** (**Pa**).
 - e. Suction static pressure in **inches wg** (**Pa**).
- I. Shaft Reports: For stairwell and elevator shafts, include the following:
- 1. Shaft Data:
 - a. System identification.
 - b. Location.
 - 2. Door Data:
 - a. Number of doors adjacent to building interior.

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC (continued):

- b. Number of doors adjacent to building exterior.
 - c. Dimensions of doors in **inches** (mm).
 - d. Door closing force in **lbs**.
- 3. Test Data at Each Condition (Indicated and Actual Values):
 - a. Total airflow rate in **cfm** (L/s).
 - b. Total system static pressure in **inches wg** (Pa).
 - c. Fan rpm.
 - d. Discharge static pressure in **inches wg** (Pa).
 - e. Suction static pressure in **inches wg** (Pa).
 - f. Differential pressure across each shaft door in **inches wg** (Pa).
- J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in **deg F** (deg C).
 - d. Duct static pressure in **inches wg** (Pa).
 - e. Duct size in **inches** (mm).
 - f. Duct area in **sq. ft.** (sq. m).
 - g. Indicated airflow rate in **cfm** (L/s).
 - h. Indicated velocity in **fpm** (m/s).
 - i. Actual airflow rate in **cfm** (L/s).
 - j. Actual average velocity in **fpm** (m/s).
 - k. Barometric pressure in **psig** (Pa).
- K. Air-Terminal-Device Reports:
 - 1. Unit Data:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Apparatus used for test.
 - d. Area served.
 - e. Make.
 - f. Number from system diagram.
 - g. Type and model number.
 - h. Size.
 - i. Effective area in **sq. ft.** (sq. m).
 - 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in **cfm** (L/s).
 - b. Air velocity in **fpm** (m/s).
 - c. Preliminary airflow rate as needed in **cfm** (L/s).
 - d. Preliminary velocity as needed in **fpm** (m/s).
 - e. Final airflow rate in **cfm** (L/s).
 - f. Final velocity in **fpm** (m/s).
 - g. Space temperature in **deg F** (deg C).
- L. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC (continued):

1. Unit Data:
 - a. System and air-handling-unit identification.
 - b. Location and zone.
 - c. Room or riser served.
 - d. Coil make and size.
 - e. Flowmeter type.
2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in **cfm** (L/s).
 - b. Entering-water temperature in **deg F** (deg C).
 - c. Leaving-water temperature in **deg F** (deg C).
 - d. Water pressure drop in **feet of head or psig** (kPa).
 - e. Entering-air temperature in **deg F** (deg C).
 - f. Leaving-air temperature in **deg F** (deg C).

M. Instrument Calibration Reports:

1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.15 **VERIFICATION OF TAB REPORT**

- A. At Engineer's option, **Engineer** shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- B. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- C. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- D. If TAB work fails, proceed as follows:
 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
 3. If the second verification also fails, design professional may contact AABC Headquarters regarding the AABC National Performance Guaranty or NEBB Headquarters regarding the NEBB Conformance Certification.
- E. Prepare test and inspection reports.

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC (continued):

3.16 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

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SECTION 230713.11 - INSULATION FOR INDOOR GENERAL HVAC DUCTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply, return, and outdoor air.
 - 2. Indoor, exposed supply, return, and outdoor air.
 - 3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
- B. Related Sections:
 - 1. Section 233113 "Metal Ducts" for duct liners.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Shop Drawings:
 - 1. Detail application for each type of insulation and hanger.
 - 2. Detail insulation application for each type of insulation.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

SECTION 230713.11 - INSULATION FOR INDOOR GENERAL HVAC DUCTS (continued):

1.06 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.07 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," and "Indoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

- 1. **Products:** Subject to compliance with requirements, provide one of the following:

- a. [CertainTeed Corp.; SoftTouch Duct Wrap.](#)
- b. [Johns Manville; Microlite.](#)
- c. [Knauf Insulation; Friendly Feel Duct Wrap.](#)
- d. [Owens Corning; SOFTR All-Service Duct Wrap.](#)

- G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

- 1. **Products:** Subject to compliance with requirements, provide one of the following:

- a. [CertainTeed Corp.; Commercial Board.](#)

SECTION 230713.11 - INSULATION FOR INDOOR GENERAL HVAC DUCTS (continued):

- b. [Johns Manville; 800 Series Spin-Glas.](#)
 - c. [Knauf Insulation; Insulation Board.](#)
 - d. [Owens Corning; Fiberglas 700 Series.](#)
- H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied [ASJ] [and] FSK jacket complying with ASTM C1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C612, Type IB. Nominal density is **2.5 lb/cu. ft. (40 kg/cu. m)** or more. Thermal conductivity (k-value) at **100 deg F (55 deg C)** is **0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K)** or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. [CertainTeed Corp.; CrimpWrap.](#)
 - b. [Johns Manville; MicroFlex.](#)
 - c. [Knauf Insulation; Pipe and Tank Insulation.](#)
 - d. [Owens Corning; Fiberglas Pipe and Tank Insulation.](#)

2.02 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. [Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.](#)
 - b. [Eagle Bridges - Marathon Industries; 225.](#)
 - c. [Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.](#)
 - d. [Mon-Eco Industries, Inc.; 22-25.](#)
 - 2. [Fiberglass adhesive shall have a](#) VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. [Adhesive shall comply with the](#) testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
- 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. [Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.](#)
 - b. [Eagle Bridges - Marathon Industries; 225.](#)
 - c. [Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.Mon-Eco Industries, Inc.; 22-25.](#)
 - 2. [Adhesive shall have a VOC](#) content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

SECTION 230713.11 - INSULATION FOR INDOOR GENERAL HVAC DUCTS (continued):

3. [Adhesive shall comply with the](#) testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.03 MASTICS AND COATINGS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
 1. [VOC Content](#): 50 g/L or less.
 2. Low-Emitting Materials: Mastic coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below ambient services.
 1. [Products](#): Subject to compliance with requirements, provide one of the following:
 - a. [Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.](#)
 - b. [Vimasco Corporation; 749.](#)
 2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 3. Service Temperature Range: **Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).**
 4. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 1. [Manufacturers](#): Subject to compliance with requirements, provide products by one of the following:
 - a. [Childers Brand; H. B. Fuller Construction Products; CP-10.](#)
 - b. [Eagle Bridges - Marathon Industries; 550.](#)
 - c. [Foster Brand; H. B. Fuller Construction Products; 46-50.](#)
 - d. [Mon-Eco Industries, Inc; 55-50.](#)
 2. [Vimasco Corporation; WC-1/WC-5.](#) Water-Vapor Permeance: ASTM E96, greater than **1.0 perm (0.66 metric perms)** at manufacturer's recommended dry film thickness.
 3. Service Temperature Range: **Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).**
 4. Color: White.

2.04 SEALANTS

- A. FSK Flashing Sealants:
 1. [Products](#): Subject to compliance with requirements, provide one of the following:
 - a. [Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.](#)
 - b. [Eagle Bridges - Marathon Industries; 405.](#)
 - c. [Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.](#)
 - d. [Mon-Eco Industries, Inc.; 44-05.](#)

SECTION 230713.11 - INSULATION FOR INDOOR GENERAL HVAC DUCTS (continued):

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: **Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).**
5. Color: Aluminum.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. ASJ Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following :
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: **Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).**
5. Color: White.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.05 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
 2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.06 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric: Approximately **6 oz./sq. yd. (203 g/sq. m)** with a thread count of **5 strands by 5 strands/sq. in. (2 strands by 2 strands/sq. mm)** for covering ducts.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Childers Brand; H. B. Fuller Construction Products; Chil-Glas Number 5.

2.07 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

SECTION 230713.11 - INSULATION FOR INDOOR GENERAL HVAC DUCTS (continued):

2.08 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 2. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ Width: **3 inches (75 mm)**.
 3. Thickness: **11.5 mils (0.29 mm)**.
 4. Adhesion: **90 ounces force/inch (1.0 N/mm)** in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: **40 lbf/inch (7.2 N/mm)** in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
1. Products: Subject to compliance with requirements, provide one of the following :
 - a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
 2. Width: **3 inches (75 mm)**.
 3. Thickness: **6.5 mils (0.16 mm)**.
 4. Adhesion: **90 ounces force/inch (1.0 N/mm)** in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: **40 lbf/inch (7.2 N/mm)** in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.09 SECUREMENTS

- A. Bands:
1. Aluminum: **ASTM B209 (ASTM B209M)**, Alloy 3003, 3005, 3105, or 5005; Temper H-14, **0.020 inch (0.51 mm)** thick, **1/2 inch (13 mm)** wide with wing seal.
 2. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Insulation Pins and Hangers:
1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) AGM Industries, Inc.
 - 2) Gemco.

SECTION 230713.11 - INSULATION FOR INDOOR GENERAL HVAC DUCTS (continued):

- 3) Midwest Fasteners, Inc.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
 - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

SECTION 230713.11 - INSULATION FOR INDOOR GENERAL HVAC DUCTS (continued):

- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.04 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

SECTION 230713.11 - INSULATION FOR INDOOR GENERAL HVAC DUCTS (continued):

1. Comply with requirements in Division 07.

3.05 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with insulation pins.

- 1.
2. Install metal, adhesively attached, perforated-base insulation hangers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions **18 inches (450 mm)** and smaller, place pins along longitudinal centerline of duct. Space **3 inches (75 mm)** maximum from insulation end joints, and **16 inches (400 mm)** o.c.
 - b. On duct sides with dimensions larger than **18 inches (450 mm)**, place pins **16 inches (400 mm)** o.c. each way, and **3 inches (75 mm)** maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
3. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing **2 inches (50 mm)** from one edge and one end of insulation segment. Secure laps to adjacent insulation section with **1/2-inch (13-mm)** outward-clinching staples, **1 inch (25 mm)** o.c. **Install vapor barrier consisting of factory- or field-applied jacket, adhesive, field-applied fabric-reinforcing mesh, vapor-barrier mastic, and sealant at joints, seams, and protrusions.**
 - a. Repair punctures, tears, and penetrations with mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below **50 deg F (10 deg C)** at **18-foot (5.5-m)** intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than **3 inches (75 mm)**.
4. Overlap unfaced blankets a minimum of **2 inches (50 mm)** on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of **18 inches (450 mm)** o.c.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with **6-inch-(150-mm-)** wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced **6 inches (150 mm)** o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Install metal, adhesively attached, perforated-base insulation hangers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions **18 inches (450 mm)** and smaller, place pins along longitudinal centerline of duct. Space **3 inches (75 mm)** maximum from insulation end joints, and **16 inches (400 mm)** o.c.

SECTION 230713.11 - INSULATION FOR INDOOR GENERAL HVAC DUCTS (continued):

- b. On duct sides with dimensions larger than **18 inches (450 mm)**, space pins **16 inches (400 mm)** o.c. each way, and **3 inches (75 mm)** maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
3. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing **2 inches (50 mm)** from one edge and one end of insulation segment. Secure laps to adjacent insulation section with **1/2-inch (13-mm)** outward-clinching staples, **1 inch (25 mm)** o.c. **Install vapor barrier consisting of factory- or field-applied jacket, adhesive, field-applied fabric-reinforcing mesh, vapor-barrier mastic, and sealant at joints, seams, and protrusions.,** tears, and penetrations with mastic to maintain vapor-barrier seal.
- a. Install vapor stops for ductwork and plenums operating below **50 deg F (10 deg C)** at **18-foot (5.5-m)** intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than **3 inches (75 mm)**.
4. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
5. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with **6-inch- (150-mm-)** wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced **6 inches (150 mm)** o.c.

3.06 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
- 1. Draw jacket smooth and tight to surface with **2-inch (50-mm)** overlap at seams and joints.
 - 2. Embed glass cloth between two **0.062-inch- (1.6-mm-)** thick coats of lagging adhesive.
 - 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
- 1. Install lap or joint strips with same material as jacket.
 - 2. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.07 FINISHES

- A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below .
- 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.

SECTION 230713.11 - INSULATION FOR INDOOR GENERAL HVAC DUCTS (continued):

- B. Color: Final color as selected by Engineer. Vary first and second coats to allow visual inspection of the completed Work.

3.08 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply, return, and outdoor air.
2. Indoor, exposed supply, return, and outdoor air.
3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

- B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.09 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, round and flat-oval, supply, return, and outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2-3/16 inches (56 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

- B. Concealed, round and flat-oval, exhaust-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2-3/16 inches (56 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

- C. Concealed, rectangular, supply, return, and outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2-3/16 inches (56 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

- D. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be the following:

1. Mineral-Fiber Blanket: 2-3/16 inches (56 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

- E. Concealed, supply, return, and outdoor-air plenum insulation shall be the following:

1. Mineral-Fiber Board: 2 inches (50 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

- F. Exposed, round and flat-oval, supply, return, and outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.

- G. Exposed, rectangular, supply, return, and outdoor-air duct insulation shall be the following:

SECTION 230713.11 - INSULATION FOR INDOOR GENERAL HVAC DUCTS (continued):

1. Mineral-Fiber Board: 2 inches (50 mm) thick and nominal density.
- H. Exposed, supply, return, and outdoor-air plenum insulation shall be the following:
 1. Mineral-Fiber Board: 2 inches (50 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

END OF SECTION 230713.11

SECTION 230719.11 - INSULATION FOR CONDENSATE DRAIN PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
 - 1. Condensate drain piping, indoors.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.06 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

SECTION 230719.11 - INSULATION FOR CONDENSATE DRAIN PIPING (continued):

- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.07 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.
- E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type I for tubular materials.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. [Aeroflex USA, Inc.; Aerocel.](#)
 - b. [Armacell LLC; AP Armaflex.](#)
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

2.02 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 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. [Aeroflex USA, Inc.; Aeroseal.](#)
 - b. [Armacell LLC; Armaflex 520 Adhesive.](#)
 - c. [Foster Brand](#), Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.

SECTION 230719.11 - INSULATION FOR CONDENSATE DRAIN PIPING (continued):

- d. [K-Flex USA](#); R-373 Contact Adhesive.

2.03 MASTICS AND COATINGS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 1. [VOC Content](#): 50 g/L or less.
 - 2. Low-Emitting Materials: Mastic coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below-ambient services.
 - 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. [Foster Brand](#), Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80 / 30-90.
 - b. [Vimasco Corporation](#); 749.
 - 2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 - 3. Service Temperature Range: **Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C)**.
 - 4. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
 - 5. Color: White.
- C. Vapor-Retarder Mastic: Solvent based; suitable for outdoor use on below-ambient services.
 - 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. [Childers Brand](#), Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
 - b. Marathon Industries; 570.
 - c. [Foster Brand](#), Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95 / 60-96.
 - 2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 - 3. Service Temperature Range: **Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C)**.
 - 4. Color: White.

2.04 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric: Approximately **2 oz./sq. yd. (68 g/sq. m)** with a thread count of **10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm)** for covering pipe and pipe fittings.
 - 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. [Childers Brand](#), Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Chil-Glas Number 10.

SECTION 230719.11 - INSULATION FOR CONDENSATE DRAIN PIPING (continued):

2.05 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.
- B. Metal Jacket:
 - 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. **Childers Brand**, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. **ITW Insulation Systems**; Aluminum and Stainless Steel Jacketing.
 - c. **RPR Products, Inc.**; Insul-Mate.
 - 2. Aluminum Jacket: Comply with **ASTM B209 (ASTM B209M)**, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: **2.5-mil- (0.063-mm-)** thick polysurlyn.
 - d. Moisture Barrier for Outdoor Applications: .
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.06 SECUREMENTS

- A. Bands:
 - 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. **ITW Insulation Systems**; Gerrard Strapping and Seals.
 - b. **RPR Products, Inc.**; Insul-Mate Strapping, Seals, and Springs.
 - 2. Stainless Steel: ASTM A167 or ASTM A240/A240M, Type 304; **0.015 inch (0.38 mm)** thick, **1/2 inch (13 mm)** wide with wing seal.
- B. Wire: **0.062-inch (1.6-mm)** soft-annealed, stainless steel.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

SECTION 230719.11 - INSULATION FOR CONDENSATE DRAIN PIPING (continued):

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Below Ambient Systems.
 - 1. Provide continuous vapor barrier; seal joints, longitudinal seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic and joint sealant.
 - 2. Where mastic is indicated provide vapor-barrier mastic as required for indoor or outdoor application.
 - 3. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

SECTION 230719.11 - INSULATION FOR CONDENSATE DRAIN PIPING (continued):

3.04 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least **2 inches (50 mm)**.
 - 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Division 07.
- D. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07.

3.05 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install mitered sections of pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 - 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 3. Install insulation to flanges as specified for flange insulation application.
 - 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.06 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 - 1. Draw jacket smooth and tight to surface with **2-inch (50-mm)** overlap at seams and joints.

SECTION 230719.11 - INSULATION FOR CONDENSATE DRAIN PIPING (continued):

2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of mastic.
 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
 4. Finish to achieve smooth, uniform finish.
- B. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.
- C. Do not install metal jacket over field-applied glass-cloth jacket unless indicated in schedule.
- D. Where PVC piping is installed in a plenum, install plenum fire resistant wrap over PVC piping. Install plenum fire resistant wrap over any PVC piping insulated with flexible elastomeric insulated, if installed in a plenum.

3.07 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating. Color per schedule below.
- B. Color: Final color as selected by Engineer. Vary first and second coats to allow visual inspection of the completed Work.
1. White.
- C. Do not field paint aluminum jackets.

3.08 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.09 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):
1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 3/4 inch (19 mm) thick.

3.10 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Piping, Concealed:
1. None.
- C. Piping, Exposed:

SECTION 230719.11 - INSULATION FOR CONDENSATE DRAIN PIPING (continued):

1. Aluminum, Corrugated: 0.016 inch (0.41 mm) thick.
- D. Fittings, valves, strainers, flanges, unions, and other specialties, Concealed:
 1. None.
- E. Fittings, valves, strainers, flanges, unions, and other specialties, Exposed:
 1. Glass cloth jacket.

END OF SECTION 230719.11

SECTION 230719.16 - INSULATION FOR REFRIGERANT PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
 - 1. Refrigerant suction and hot-gas piping, indoors and outdoors.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.06 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

SECTION 230719.16 - INSULATION FOR REFRIGERANT PIPING (continued):

- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.07 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.
- E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type I for tubular materials.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. [Aeroflex USA, Inc.; Aerocel.](#)
 - b. [Armacell LLC; AP Armaflex.](#)
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

2.02 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 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. [Aeroflex USA, Inc.; Aero seal.](#)
 - b. [Armacell LLC; Armaflex 520 Adhesive.](#)
 - c. [Foster Brand](#), Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.

SECTION 230719.16 - INSULATION FOR REFRIGERANT PIPING (continued):

- d. [K-Flex USA](#); R-373 Contact Adhesive.

2.03 MASTICS AND COATINGS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 1. [VOC Content](#): 50 g/L or less.
 - 2. Low-Emitting Materials: Mastic coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below-ambient services.
 - 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. [Foster Brand](#), Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80 / 30-90.
 - b. [Vimasco Corporation](#); 749.
 - 2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 - 3. Service Temperature Range: **Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C)**.
 - 4. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
 - 5. Color: White.
- C. Vapor-Retarder Mastic: Solvent based; suitable for outdoor use on below-ambient services.
 - 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. [Childers Brand](#), Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
 - b. Marathon Industries; 570.
 - c. [Foster Brand](#), Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95 / 60-96.
 - 2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 - 3. Service Temperature Range: **Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C)**.
 - 4. Color: White.

2.04 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.
- B. Metal Jacket:
 - 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. [Childers Brand](#), Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.

SECTION 230719.16 - INSULATION FOR REFRIGERANT PIPING (continued):

- b. [ITW Insulation Systems](#); Aluminum and Stainless Steel Jacketing.
 - c. [RPR Products, Inc.](#); Insul-Mate.
2. Aluminum Jacket: Comply with **ASTM B209** (**ASTM B209M**), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
- a. Sheet and roll stock ready for shop or field sizing.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: **2.5-mil-** (**0.063-mm-**) thick polysurlyn.
 - d. Moisture Barrier for Outdoor Applications: .
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.05 SECUREMENTS

A. Bands:

- 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. [ITW Insulation Systems](#); Gerrard Strapping and Seals.
 - b. [RPR Products, Inc.](#); Insul-Mate Strapping, Seals, and Springs.
- 2. Stainless Steel: ASTM A167 or ASTM A240/A240M, Type 304; **0.015 inch** (**0.38 mm**) thick, **1/2 inch** (**13 mm**) wide with wing seal.

B. Wire: **0.062-inch (**1.6-mm**) soft-annealed, stainless steel.**

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
- 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

SECTION 230719.16 - INSULATION FOR REFRIGERANT PIPING (continued):

- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Below Ambient Systems.
 - 1. Provide continuous vapor barrier; seal joints, longitudinal seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic and joint sealant.
 - 2. Where mastic is indicated provide vapor-barrier mastic as required for indoor or outdoor application.
 - 3. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.04 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

SECTION 230719.16 - INSULATION FOR REFRIGERANT PIPING (continued):

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Division 07 for firestopping and fire-resistive joint sealers.
- D. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07.

3.05 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.06 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

SECTION 230719.16 - INSULATION FOR REFRIGERANT PIPING (continued):

1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
 2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of mastic.
 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
 4. Finish to achieve smooth, uniform finish.
- B. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.07 FINISHES

- A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below .
1. Semi-glass Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof. Color per schedule below.
 - a. Finish Coat Material: Interior, semi-gloss, latex-emulsion size.
 2. Paint exposed piping without field applied metal jacket.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating. Color per schedule below.
- C. Color: Final color as selected by Engineer. Vary first and second coats to allow visual inspection of the completed Work.
1. White.
- D. Do not field paint aluminum jackets.

3.08 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.09 INDOOR PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping:
1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch (25 mm) thick.
- B. Refrigerant Suction and Hot-Gas Flexible Tubing:
1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch (25 mm) thick.

SECTION 230719.16 - INSULATION FOR REFRIGERANT PIPING (continued):

3.10 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch (25 mm) thick.
- B. Refrigerant Suction and Hot-Gas Flexible Tubing:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch (25 mm) thick.

3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Piping, Concealed:
 - 1. None.
- C. Piping, Exposed:
 - 1. Aluminum, Corrugated: 0.016 inch (0.41 mm) thick.

3.12 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. Aluminum, Corrugated: 0.024 inch (0.61 mm) thick.
- D. Piping, Exposed:
 - 1. Aluminum, Corrugated: 0.024 inch (0.61 mm) thick.

END OF SECTION 230719.16

SECTION 232113.11 - CONDENSATE DRAIN PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Piping joining materials.
3. Dielectric fittings.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Pipe and tube.
2. Fittings.
3. Joining materials.
4. Transition fittings.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation are to be capable of withstanding the following minimum working pressures and temperatures unless otherwise indicated:**
1. Condensate-Drain Piping: 150 deg F (66 deg C).

2.02 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tube: ASTM B88, Type L (ASTM B88M, Type B).**
- B. Wrought-Copper, Solder-Joint Fittings: ASME B16.22 pressure fittings. Do not use solder joints on pipe sizes greater than NPS 4 (DN 100).**
- C. Wrought-Copper Unions: ASME B16.22. Do not use solder joints on pipe sizes greater than NPS 4 (DN 100).**
- D. Copper-Tube, Pressure-Seal-Joint Fittings - Copper or Bronze:**
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Mueller Streamline Co.; a company of Mueller Industries.
 - b. Victaulic Company.
 - c. Viega LLC.

SECTION 232113 - HYDRONIC PIPING (continued):

2. Source Limitations: Obtain copper-tube pressure-seal-joint fittings from single manufacturer.
3. Housing: Copper or bronze.
4. O-Rings and Pipe Stops: EPDM.
5. Tools: Manufacturer's special tools.
6. Minimum 200 psig (1370 kPa) working pressure rating at 250 deg F (121 deg C).

2.03 PIPING JOINING MATERIALS

- A. Solder Filler Metals: ASTM B32, lead-free alloys.
- B. Flux: ASTM B813, water flushable.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS

- A. Condensate-Drain Piping Installed Aboveground to Be Any of the Following:
 1. Type L (Type B), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

3.02 INSTALLATION OF PIPING

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

SECTION 232113 - HYDRONIC PIPING (continued):

- M. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- N. Install unions in piping, **NPS 2 (DN 50)** and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- O. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.
- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.03 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints in accordance with ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B32.
- D. Pressure-Seal Joints: Use manufacturer-recommended tools and procedure. Leave insertion marks on pipe after assembly.

3.04 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.
- B. Install hangers for copper tubing , with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- C. Support horizontal piping within **12 inches (300 mm)** of each fitting and coupling.
- D. Support vertical runs of copper tubing to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.05 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 230553 "Identification for HVAC Piping and Equipment."

SECTION 232113 - HYDRONIC PIPING (continued):

3.06 **FIELD QUALITY CONTROL**

- A. Prepare hydronic piping in accordance with ASME B31.9 and as follows:
 - 1. Leave joints uninsulated and exposed for examination during test.
 - 2. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
- B. Perform the following tests on hydronic piping:
 - 1. Use ambient-temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 - 2. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure is not to exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9.
 - 3. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
 - 4. Prepare written report of testing.

END OF SECTION 232113.11

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Refrigerant pipes and fittings.
 - 2. Refrigerant piping valves and specialties.
 - 3. Refrigerants.

1.03 ACTION SUBMITTALS

- A. Shop Drawings:
 - 1. Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes; flow capacities; valve arrangements and locations; slopes of horizontal runs; oil traps; double risers; wall and floor penetrations; and equipment connection details.
 - 2. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
 - 3. Show interface and spatial relationships between piping and equipment.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.06 PRODUCT STORAGE AND HANDLING

- A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.

SECTION 232300 - REFRIGERANT PIPING (continued):

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction Lines for Heat-Pump Applications: 535 psig (3689 kPa).
 - 2. Hot-Gas and Liquid Lines: 535 psig (3689 kPa).

2.02 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88, Type K or L (ASTM B 88M, Type A or B).
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

2.03 VALVES AND SPECIALTIES

- A. Service Valves:
 - 1. Body: Forged brass with brass cap including key end to remove core.
 - 2. Core: Removable ball-type check valve with stainless-steel spring.
 - 3. Seat: Polytetrafluoroethylene.
 - 4. End Connections: Copper spring.
 - 5. Working Pressure Rating: 500 psig (3450 kPa).
- B. Safety Relief Valves: Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
 - 1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
 - 2. Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 3. Seat: Polytetrafluoroethylene.
 - 4. End Connections: Threaded.
 - 5. Working Pressure Rating: 400 psig (2760 kPa).
 - 6. Maximum Operating Temperature: 240 deg F (116 deg C).
- C. Thermostatic Expansion Valves: Comply with AHRI 750.
 - 1. Body, Bonnet, and Seal Cap: Forged brass or steel.
 - 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 3. Packing and Gaskets: Non-asbestos.
 - 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
 - 5. Suction Temperature: 40 deg F (4.4 deg C).
 - 6. Superheat: Adjustable.
 - 7. Reverse-flow option (for heat-pump applications).
 - 8. End Connections: Socket, flare, or threaded union.
 - 9. Working Pressure Rating: 700 psig (4820 kPa).
- D. Moisture/Liquid Indicators:
 - 1. Body: Forged brass.
 - 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.

SECTION 232300 - REFRIGERANT PIPING (continued):

3. Indicator: Color coded to show moisture content in parts per million (ppm).
 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
 5. End Connections: Socket or flare.
 6. Working Pressure Rating: 500 psig (3450 kPa).
 7. Maximum Operating Temperature: 240 deg F (116 deg C).
- E. Replaceable-Core Filter Dryers: Comply with AHRI 730.
1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 3. Desiccant Media: Activated alumina or charcoal.
 4. Designed for reverse flow (for heat-pump applications).
 5. End Connections: Socket.
 6. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
 7. Working Pressure Rating: 500 psig (3450 kPa).
 8. Maximum Operating Temperature: 240 deg F (116 deg C).

2.04 REFRIGERANTS

- A. ASHRAE 34, R-22: Monochlorodifluoromethane.
- B. ASHRAE 34, R-134a: Tetrafluoroethane.
- C. ASHRAE 34, R-407C: Difluoromethane/Pentafluoroethane/1,1,1,2-Tetrafluoroethane.
- D. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines NPS 4 (DN 100) and Smaller for Conventional Air-Conditioning Applications: Copper, Type L (B), drawn-temper tubing and wrought-copper fittings with soldered joints.
- B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type L (B), drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.
- C. Safety-Relief-Valve Discharge Piping: Copper, Type L (B), drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

3.02 VALVE AND SPECIALTY APPLICATIONS

- A. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.
- B. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.
- C. Install thermostatic expansion valves as close as possible to distributors on evaporators.

SECTION 232300 - REFRIGERANT PIPING (continued):

1. Install valve so diaphragm case is warmer than bulb.
 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- D. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.
- E. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- F. Install filter dryers in liquid line between compressor and thermostatic expansion valve.
- G. Install receivers sized to accommodate pump-down charge.
- H. Install flexible connectors at compressors.

3.03 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- K. Install refrigerant piping in protective conduit where installed belowground.
- L. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- M. Slope refrigerant piping as follows:
1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 2. Install horizontal suction lines with a uniform slope downward to compressor.
 3. Liquid lines may be installed level.

SECTION 232300 - REFRIGERANT PIPING (continued):

- N. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- O. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- P. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.04 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

3.05 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.
- B. Install the following pipe attachments:
 - 1. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Support horizontal piping within 12 inches (300 mm) of each fitting.
- E. Support vertical runs of copper tubing to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.06 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Comply with ASME B31.5, Chapter VI.
 - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.

SECTION 232300 - REFRIGERANT PIPING (continued):

- b. System shall maintain test pressure at the manifold gage throughout duration of test.
- c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
- d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

3.07 SYSTEM CHARGING

A. Charge system using the following procedures:

- 1. Install core in filter dryers after leak test but before evacuation.
- 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
- 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
- 4. Charge system with a new filter-dryer core in charging line.

3.08 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

- 1. Open shutoff valves in condenser water circuit.
- 2. Verify that compressor oil level is correct.
- 3. Open compressor suction and discharge valves.
- 4. Open refrigerant valves except bypass valves that are used for other purposes.
- 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

D. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 233113.11 - METAL DUCTS FOR GENERAL HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes duct services for supply, return, outdoor air, and general exhaust (ASHRAE 62.1, Class 1 and 2):
 - 1. Single-wall rectangular ducts and fittings.
 - 2. Single-wall round and flat-oval ducts and fittings.
 - 3. Sheet metal materials.
 - 4. Sealants and gaskets.
 - 5. Hangers and supports.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Liners and adhesives.
 - 2. Sealants and gaskets.
- B. Delegated-Design Submittal:
 - 1. Sheet metal thicknesses.
 - 2. Joint and seam construction and sealing.
 - 3. Reinforcement details and spacing.
 - 4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans or BIM model, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 - 2. Suspended ceiling components.
 - 3. Structural members to which duct will be attached.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Penetrations of smoke barriers and fire-rated construction.
 - 6. Items penetrating finished ceiling including the following:
 - a. Luminaires (Lighting fixtures).
 - b. Air outlets and inlets.

SECTION 233113.11 - METAL DUCTS FOR GENERAL HVAC (continued):

- c. Speakers.
- d. Sprinklers.
- e. Access panels.
- f. Perimeter moldings.
- g. Fire alarm devices.
- h. Lighting control devices.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".
- C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.
- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."
- E. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
- F. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.02 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
 - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
 - 2. For ducts exposed to weather, comply with requirements per "Ductwork Exposed to Weather" Article.
- B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. For ducts with longest side less than 36 inches (914 mm), select joint types in accordance with Figure 2-1.
 - 2. For ducts with longest side 36 inches (914 mm) or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.

SECTION 233113.11 - METAL DUCTS FOR GENERAL HVAC (continued):

- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All longitudinal seams shall be Pittsburgh lock seams unless otherwise specified for specific application.
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
 - 2. For ducts exposed to weather, comply with requirements per "Ductwork Exposed to Weather" Article.
 - 3. Basis-of-Design Product: Subject to compliance with requirements, provide SEMCO, LLC; SEMCO Single-Wall Round Duct & Fittings or a comparable product by one of the following:
 - a. Crown Products Company, Inc.
 - b. McGill AirFlow LLC.
 - c. Sheet Metal Connectors, Inc.
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- C. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Transverse Joints in Ducts Larger Than 60 (1524) Inches (mm) in Diameter: Flanged.
- D. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Fabricate round ducts larger than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.
 - 2. Fabricate flat-oval ducts larger than 72 inches (1830 mm) in width (major dimension) with butt-welded longitudinal seams.
- E. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

SECTION 233113.11 - METAL DUCTS FOR GENERAL HVAC (continued):

2.04 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - 1. Galvanized Coating Designation: **G90 (Z275)**.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as indicated in "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in "Duct Schedule" Article.
- D. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- E. Tie Rods: Galvanized steel, **1/4-inch- (6-mm-)** minimum diameter for lengths **36 inches (900 mm)** or less; **3/8-inch- (10-mm-)** minimum diameter for lengths longer than **36 inches (900 mm)**.

2.05 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
- B. Water-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.
 - 2. Solids Content: Minimum 65 percent.
 - 3. Shore A Hardness: Minimum 20.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. VOC: Maximum 75 g/L (less water).
 - 7. Maximum Static-Pressure Class: **10 inch wg (2500 Pa)**, positive and negative.
 - 8. Service: Indoor or outdoor.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- C. Flanged Joint Sealant: Comply with ASTM C920.
 - 1. General: Single-component, acid-curing, silicone, elastomeric.
 - 2. Type: S.
 - 3. Grade: NS.
 - 4. Class: 25.
 - 5. Use: O.
 - 6. Sealant shall have a VOC content of 420 g/L or less.

SECTION 233113.11 - METAL DUCTS FOR GENERAL HVAC (continued):

7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- E. Round Duct Joint O-Ring Seals:
 1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.
 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.06 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.
- E. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- G. Trapeze and Riser Supports:
 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.
- B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths with fewest possible joints.

SECTION 233113.11 - METAL DUCTS FOR GENERAL HVAC (continued):

- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of **1 inch (25 mm)**, plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least **1-1/2 inches (38 mm)**.
- J. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
- K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation.
- L. Elbows: Use long-radius elbows wherever they fit.
 - 1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
 - 2. Fabricate 90-degree round elbows with a minimum of three segments for **12 inches (300 mm)** and smaller and a minimum of five segments for **14 inches (350 mm)** and larger.
- M. Branch Connections: Use lateral or conical branch connections.

3.02 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

SECTION 233113.11 - METAL DUCTS FOR GENERAL HVAC (continued):

- B. Seal ducts to Seal Class A in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

3.04 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1220 mm) of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.05 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.

3.07 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:

SECTION 233113.11 - METAL DUCTS FOR GENERAL HVAC (continued):

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 2. Test the following systems:
 - a. Ducts with a Pressure Class of 3-Inch wg (750 Pa) or Greater: Test representative duct sections, selected by Engineer from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.
 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 4. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.
 5. Test for leaks before applying external insulation.
 6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 7. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
1. Visually inspect duct system to ensure that no visible contaminants are present.
 2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- 3.08 **STARTUP**
- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."
- 3.09 **DUCT SCHEDULE**
- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.
- B. Supply Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive 2- (500)inch wg (Pa).
- C. Return Ducts:

SECTION 233113.11 - METAL DUCTS FOR GENERAL HVAC (continued):

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 2- (500)inch wg (Pa).
- D. Exhaust Ducts:
 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2- (500)inch wg (Pa).
 2. Ducts Connected to Equipment Not Listed above:
 - a. Pressure Class: Positive or negative 2- (500)inch wg (Pa).
- E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 2- (500)inch wg (Pa).
- F. Intermediate Reinforcement:
 1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.
- G. Elbow Configuration:
 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - 1) Mitered elbows are not permitted in Noise Critical Spaces.
 2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - b. Round Elbows, 12 (305) Inches (mm) and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 (356) Inches (mm) and Larger in Diameter: Welded.
- H. Branch Configuration:
 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: 45-degree entry.

SECTION 233113.11 - METAL DUCTS FOR GENERAL HVAC (continued):

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm (5 m/s) or Lower: Conical tap.
 - b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
 - c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 233113.11

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Backdraft and pressure relief dampers.
 - 2. Manual volume dampers.
 - 3. Control dampers.
 - 4. Smoke dampers.
 - 5. Flange connectors.
 - 6. Turning vanes.
 - 7. Duct-mounted access doors.
 - 8. Duct access panel assemblies.
 - 9. Flexible connectors.
 - 10. Duct accessory hardware.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For duct silencers, include pressure drop, dynamic insertion loss, and self-generated noise data. Include breakout noise calculations for high-transmission-loss casings.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

SECTION 233300 - AIR DUCT ACCESSORIES (continued):

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 90A and NFPA 90B.
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.02 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Ruskin Company; CBD4 or a comparable product by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Nailor Industries Inc.
- B. Description: Gravity balanced with adjustable counterweights.
- C. Performance:
 - 1. Maximum Air Velocity: 2000 fpm (10 m/s).
 - 2. Maximum System Pressure: 3 inches wg (0.8 kPa).
 - 3. AMCA Certification: Test and rate in accordance with AMCA 511.
- D. Construction:
 - 1. Frame:
 - a. Hat shaped.
 - b. 0.093-inch- (2.4-mm-) thick extruded aluminum, with welded or mechanically attached corners.
 - 2. Blades:
 - a. Multiple single-piece blades.
 - b. End pivoted, maximum 6-inch (150-mm) width, 0.050-inch- (1.2-mm-) thick aluminum sheet with sealed edges.
 - 3. Blade Action: Parallel.
- E. Blade Seals: Extruded vinyl, mechanically locked.
- F. Blade Axles:
 - 1. Material: Nonmetallic.
 - 2. Diameter: 0.50 inch (13 mm) .
- G. Tie Bars and Brackets: Aluminum.
- H. Return Spring: Adjustable tension.

SECTION 233300 - AIR DUCT ACCESSORIES (continued):

- I. Bearings: Steel ball.
- J. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure between 0.01-inch wg (0.003 kPa) and 0.05-inch wg (0.013 kPa).
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. 90-degree stops.

2.03 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Ruskin Company; MD35 (rectangular) and MDRS25 (round) or a comparable product by one of the following:
 - a. Greenheck Fan Corporation.
 - b. Nailor Industries Inc.
 - 2. Performance:
 - a. Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. (203 L/s per sq. m) against 1-inch wg (250-Pa) differential static pressure.
 - 3. Construction:
 - a. Linkage out of airstream.
 - b. Suitable for horizontal or vertical airflow applications.
 - 4. Frames:
 - a. Hat-shaped, 16-gauge- (1.6-mm-) thick, galvanized sheet steel.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized steel; 16 gauge (1.6 mm) thick.
 - 6. Blade Axles: Galvanized steel.
 - 7. Bearings:
 - a. Molded synthetic.
 - b. Dampers mounted with vertical blades to have thrust bearing at each end of every blade.
 - 8. Tie Bars and Brackets: Galvanized steel.
 - 9. Locking device to hold damper blades in a fixed position without vibration.

SECTION 233300 - AIR DUCT ACCESSORIES (continued):

2.04 CONTROL DAMPERS

- A. **Basis-of-Design Product:** Subject to compliance with requirements, provide Ruskin Company; CD60 or a comparable product by one of the following:
1. Greenheck Fan Corporation.
 2. Nailor Industries Inc.
- B. General Requirements:
1. Unless otherwise indicated, use parallel-blade configuration for two-position control, equipment isolation service, and when mixing two airstreams. For other applications, use opposed-blade configuration.
 2. Factory or field assemble multiple damper sections to provide a single damper assembly of size required by the application.
- C. Performance:
1. AMCA Certification: Test and rate in accordance with AMCA 511.
 2. Leakage:
 - a. Class IA: Leakage shall not exceed **3 cfm/sq. ft. (15.2 L/s per sq. m)** against **1-inch wg (250-Pa)** differential static pressure.
 3. Pressure Drop: **0.05 inch wg (12.5 Pa)** at **1500 fpm (7.6 m/s)** across a **24-by-24-inch (600-by-600-mm)** damper when tested in accordance with AMCA 500-D, Figure 5.3.
 4. Velocity: Up to **3000 fpm (15 m/s)**.
 5. Temperature: **Minus 25 to plus 180 deg F (Minus 32 to plus 83 deg C)**.
 6. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.
- D. Construction:
1. Linkage out of airstream.
 2. Suitable for horizontal or vertical airflow applications.
 3. Frames:
 - a. Hat, U, or angle shaped.
 - b. **16-gauge- (1.6-mm-)** thick, galvanized sheet steel.
 - c. Mitered and welded corners.
 - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
 4. Blades:
 - a. Multiple blade with maximum blade width of **6 inches (150 mm)**.
 - b. Opposed-blade design.
 - c. Galvanized steel.
 - d. **14-gauge- (1.9-mm-)** thick air foil dual skin.
 5. Blade Edging Seals:
 - a. Replaceable Closed-cell neoprene.
 - b. Inflatable seal blade edging, or replaceable rubber seals.
 6. Blade Jamb Seal: Flexible stainless steel, compression type.

SECTION 233300 - AIR DUCT ACCESSORIES (continued):

7. Blade Axles: **1/2-inch (13-mm)** diameter; galvanized steel.
8. Blade-Linkage Hardware: Zinc-plated steel and brass; ends sealed against blade bearings. Linkage mounted out of air stream.
9. Bearings:
 - a. Oil-impregnated stainless steel sleeve.
 - b. Dampers mounted with vertical blades to have thrust bearings at each end of every blade.

E. Damper Operators: Comply with requirements in Section 250923.12 "Control Damper Accessories."

2.05 SMOKE DAMPERS

A. **Basis-of-Design Product:** Subject to compliance with requirements, provide **Ruskin Company**; SD60 or a comparable product by one of the following:

1. **Greenheck Fan Corporation.**
2. **Nailor Industries Inc.**

B. General Requirements:

1. Label to indicate conformance to UL 555 and UL 555S by an NRTL.
2. Label to indicate conformance to NFPA 80 and NFPA 90A by an NRTL.
3. Unless otherwise indicated, use parallel-blade configuration.
4. Factory or field assemble multiple damper sections to provide a single damper assembly of size required by the application.
5. Factory install damper actuator by damper manufacturer as integral part of damper assembly. Coordinate actuator location, mounting, and electrical requirements with damper manufacturer.

C. Performance:

1. AMCA Certification: Test and rate in accordance with AMCA Publication 511.
2. Leakage:
 - a. Class I: Leakage shall not exceed **4 cfm/sq. ft. (20 L/s/ per sq. m)** against **1-inch wg (250-Pa)** differential static pressure.
3. Pressure Drop: **0.05 inch wg (12.5 Pa)** at **1500 fpm (7.6 m/s)** across a **24-by-24-inch (600-by-600-mm)** damper when tested in accordance with AMCA 500-D, Figure 5.3.
4. Velocity: Up to **3000 fpm (15 m/s)**.
5. Temperature: **Minus 25 to plus 180 deg F (Minus 32 to plus 83 deg C)**.
6. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.

D. Construction:

1. Suitable for horizontal or vertical airflow applications.
2. Linkage out of airstream.
3. Frame:
 - a. Hat shaped.
 - b. Galvanized sheet steel, with welded corners and mounting flange.
 - c. Gauge in accordance with UL listing.
4. Blades:

SECTION 233300 - AIR DUCT ACCESSORIES (continued):

- a. Roll-formed, opposed-blade, horizontal, airfoil, galvanized sheet steel.
 - b. Maximum width and gauge in accordance with UL listing.
- 5. Blade Edging Seals:
 - a. Silicone rubber.
- 6. Blade Jamb Seal: Flexible stainless steel, compression type.
- 7. Blade Axles: **1/2-inch (13-mm)** diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings. Linkage is to be mounted out of airstream.
- 8. Bearings:
 - a. Oil-impregnated stainless steel sleeve.
- E. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application; gauge in accordance with UL listing.
- F. Damper Operators: Comply with requirements in Section 250923.12 "Control Damper Accessories."
- G. Accessories:
 - 1. Auxiliary switches for position indication.
 - 2. Test and reset switches, damper mounted.
 - 3. Smoke Detector: Furnished by Division 29.

2.06 FLANGE CONNECTORS

- A. Description: Add-on or roll-formed, factory fabricated, slide-on transverse flange connectors, gaskets, and components.
- B. Material: Galvanized steel.
- C. Gauge and Shape: Match connecting ductwork.

2.07 TURNING VANES

- A. Manufactured Turning Vanes for Metal Ducts: Fabricate curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
- C. Vane Construction:
 - 1. Single wall for ducts up to **48 inches (1200 mm)** wide and double wall for larger dimensions.

SECTION 233300 - AIR DUCT ACCESSORIES (continued):

2.08 DUCT-MOUNTED ACCESS DOORS

- A. Duct-Mounted Access Doors: Fabricate access panels in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 7-2 (7-2M), "Duct Access Doors and Panels," and Figure 7-3, "Access Doors - Round Duct."
1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. ~~24-gauge-~~ (0.70-mm-) thick galvanized steel or ~~24-gauge-~~ (0.70-mm-) thick stainless steel door panel.
 - d. Hinges and Latches: ~~1-by-1-inch~~ (25-by-25-mm) butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - a. ~~24-gauge-~~ (0.70-mm-) thick galvanized steel or ~~0.032-inch-~~ (0.81-mm-) thick aluminum frame.
 3. Number of Hinges and Locks:
 - a. Access Doors Less Than ~~12 Inches~~ (300 mm) Square: No hinges and two sash locks.
 - b. Access Doors up to ~~18 Inches~~ (460 mm) Square: Two hinges and two sash locks.
 - c. Access Doors up to ~~24 by 48 Inches~~ (600 by 1200 mm): Three hinges and two compression latches with outside and inside handles.
 - d. Access Doors Larger Than ~~24 by 48 Inches~~ (600 by 1200 mm): Four hinges and two compression latches with outside and inside handles.

2.09 DUCT ACCESS PANEL ASSEMBLIES

- A. Access panels used in cooking applications:
1. Labeled compliant to NFPA 96 for grease duct access doors.
 2. Labeled in accordance with UL 1978 by an NRTL.
- B. Panel and Frame: Minimum thickness ~~16-gauge~~ (1.6-mm) stainless steel.
- C. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.
- D. Gasket: Comply with NFPA 96, grease-tight, high-temperature ceramic fiber, rated for minimum ~~2000 deg F~~ (1093 deg C).
- E. Minimum Pressure Rating: ~~10 inches wg~~ (2500 Pa) positive or negative.

2.10 FLEXIBLE CONNECTORS

- A. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.

SECTION 233300 - AIR DUCT ACCESSORIES (continued):

- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Materials: Flame-retardant or noncombustible fabrics.
- D. Coatings and Adhesives: Comply with UL 181, Class 1.
- E. Metal-Edged Connectors: Factory fabricated with a fabric strip **5-3/4 inches (146 mm)** wide attached to two strips of **2-3/4-inch- (70-mm-)** wide, **0.028-inch- (0.7-mm-)** thick, galvanized sheet steel or **0.032-inch- (0.8-mm-)** thick aluminum sheets. Provide metal compatible with connected ducts.
- F. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: **26 oz./sq. yd. (880 g/sq. m).**
 - 2. Tensile Strength: **480 lbf/inch (84 N/mm)** in the warp and [**360 lbf/inch (63 N/mm)**] in the filling.
 - 3. Service Temperature: **Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).**

2.11 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

2.12 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - 1. Galvanized Coating Designation: **G90 (Z275).**
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless Steel Sheets: Comply with ASTM A480/A480M, Type 304, and having a No. 2D finish for concealed ducts and No. 2B finish for exposed ducts.
- C. Aluminum Sheets: Comply with **ASTM B209 (ASTM B209M)**, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, one-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with **ASTM B221 (ASTM B221M)**, Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.
- F. Tie Rods: Galvanized steel, **1/4-inch (6-mm)** minimum diameter for lengths **36 inches (900 mm)** or less; **3/8-inch (10-mm)** minimum diameter for lengths longer than **36 inches (900 mm).**

PART 3 - EXECUTION

3.01 COORDINATION OF WORK WITH OTHER TRADES

- A. Smoke Dampers and Combination Fire and Smoke Dampers:
 - 1. Damper furnished and installed by Division 23.

SECTION 233300 - AIR DUCT ACCESSORIES (continued):

2. Damper actuator furnished and installed by Division 23.
3. Electrical power for damper actuator furnished and installed by Division 26.
4. Smoke detector furnished by Division 29.
5. Smoke detector installed in ductwork by Division 23.
6. Control and/or signal wiring for smoke detector and damper actuator furnished and installed by Division 29.

B. Control Dampers:

1. Damper furnished and installed by Division 23.
2. Damper actuator furnished and installed by Division 25.

3.02 INSTALLATION

- A. Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116 for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full system design static pressure.
- E. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 1. Install steel volume dampers in steel ducts.
 2. Install aluminum volume dampers in aluminum ducts.
- F. Set dampers to fully open position before testing, adjusting, and balancing.
- G. Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.
- H. Install fire and smoke dampers in accordance with UL listing.
- I. Connect ducts to duct silencers rigidly.
- J. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 1. At outdoor-air intakes and mixed-air plenums.
 2. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links.
 3. Control devices requiring inspection.
 4. Elsewhere as indicated.
- K. Install access doors with swing against duct static pressure.
- L. Access Door Sizes:

SECTION 233300 - AIR DUCT ACCESSORIES (continued):

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
 2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
 3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
 4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
 5. Body Access: 25 by 14 inches (635 by 355 mm).
 6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).
- M. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- N. Install flexible connectors to connect ducts to equipment.
- O. For fans developing static pressures of 5 inches wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- P. Install duct test holes where required for testing and balancing purposes.

3.03 FLEXIBLE CONNECTOR SCHEDULE

- A. Indoor equipment, non-corrosive environment with airstream not in excess of 200 deg F (93 deg C):
Indoor system, flexible connector fabric.

3.04 FIELD QUALITY CONTROL

- A. Tests and Inspections:
1. Operate dampers to verify full range of movement.
 2. Inspect locations of access doors, and verify that size and location of access doors are adequate to perform required operation.
 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and that proper heat-response device is installed.
 4. Inspect turning vanes for proper and secure installation, and verify that vanes do not move or rattle.
 5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233346 - FLEXIBLE DUCTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Insulated flexible ducts.
 - 2. Flexible duct elbow supports.

1.03 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."
- D. Comply with ASTM E96/E96M, "Test Methods for Water Vapor Transmission of Materials."

2.02 INSULATED FLEXIBLE DUCTS

- A. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Flexmaster U.S.A., Inc; 1M.
 - 2. JP Lamborn Co.; AMR.
 - 3. Thermafex; a Flex-Tek Group company; M-KE.
 - 4. Atco; UPC 036.
- B. Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film or polyethylene fabric supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

SECTION 233346 - FLEXIBLE DUCTS (continued):

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).
4. Insulation R-Value: R6.

2.03 FLEXIBLE DUCT CONNECTORS

- A. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.

2.04 FLEXIBLE DUCT ELBOW SUPPORTS

- A. **Products:** Subject to compliance with requirements, provide one of the following:
 1. **Flexmaster U.S.A., Inc;** FlexRight.
 2. **Malco;** FDS1.
 3. **Titus;** FlexRight.
 4. **Thermaflex; a Flex-Tek Group company;** FlexFlow.
- B. 90-degree Elbow: UL 2043, universal-mount, one-piece, fully adjustable, radius-forming brace to support 4-inch (102-mm) through 16-inch (406-mm) diameter flexible air ducts; copolymer polypropylene.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install flexible ducts according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install in indoor applications only. Flexible ductwork should not be exposed to UV lighting.
- C. Connect terminal units to supply ducts with maximum 24-inch (600-mm) lengths of flexible duct. Do not use flexible ducts to change directions.
- D. Connect diffusers to ducts with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.
- E. Connect flexible ducts to metal ducts with draw bands.
- F. Installation:
 1. Install ducts fully extended.
 2. Do not bend ducts across sharp corners.
 3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
 4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
 5. Install flexible ducts in a direct line, without sags, twists, or turns.
 6. Install flexible duct elbow supports in accordance with manufacturer's instructions.

SECTION 233346 - FLEXIBLE DUCTS (continued):

7. Install flexible duct elbow supports over outer jacket of flexible ducts to form smooth, 90-degree bends to eliminate flexible duct kinks and airflow restrictions. Secure flexible duct to flexible duct elbow support with nylon cable ties.
 8. Install flexible duct elbow supports at 90-degree bends at the following locations:
 - a. Diffusers, registers, and grilles.
 - b. Duct take-offs and taps.
 - c. Air devices with round inlets and outlets.
 - d. Flexible ducts being used as elbows.
- G. Supporting Flexible Ducts:
1. Suspend flexible ducts with bands **1-1/2 inches (38 mm)** wide or wider and spaced a maximum of **48 inches (1200 mm)** apart. Maximum centerline sag between supports shall not exceed **1/2 inch (13 mm)** per **12 inches (300 mm)**.
 2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
 3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.
 4. Vertically installed ducts shall be stabilized by support straps at a maximum of **72 inches (1800 mm)** o.c.

END OF SECTION 233346

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SECTION 233416.11 – SQUARE IN-LINE CENTRIFUGAL FANS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Square in-line centrifugal fans.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
 - 2. Rated capacities, operating characteristics, and furnished specialties and accessories.
 - 3. Certified fan performance curves with system operating conditions indicated.
 - 4. Certified fan sound-power ratings.
 - 5. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 6. Material thickness and finishes, including color charts.
 - 7. Dampers, including housings, linkages, and operators.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Fan room layout and relationships between components and adjacent structural and mechanical elements, drawn to scale, and coordinated with each other, using input from installers of the items involved.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For centrifugal fans to include in normal operation, emergency operation, and maintenance manuals with replacement parts listing.

1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Belts: One set(s) for each belt-driven unit.

SECTION 233416.11 - SQUARE IN-LINE CENTRIFUGAL FANS (continued):

PART 2 - PRODUCTS

2.01 SQUARE IN-LINE CENTRIFUGAL FANS

- A. **Basis-of-Design Product:** Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Carnes Company.
 2. Greenheck Fan Corporation.
 3. Loren Cook Company.
 4. PennBarry.
- B. Description: Square in-line centrifugal fans.
- C. Housing:
1. Housing Material: Reinforced galvanized steel .
 2. Housing Coating: None.
 3. Housing Construction: Side panels shall be easily removable for service. Include inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- D. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- E. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosures around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- F. Fan Wheels: Aluminum airfoil blades welded to aluminum hub.
- G. Motor Enclosure: Totally enclosed, fan cooled.
- H. Accessories:
1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
 2. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 3. Companion Flanges: For inlet and outlet duct connections.
 4. Fan Guards: 1/2- by 1-inch (13- by 25-mm) mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
 5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
 6. Side Discharge: Flange connector and attachment hardware to provide right-angle discharge on side of unit.
 7. Insulated Housing: Fiberglass duct liner for the interior of unit to provide a reduction in noise.

2.02 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
- B. Where variable-frequency drives are indicated or scheduled, provide fan motor compatible with variable-frequency drive.

SECTION 233416.11 - SQUARE IN-LINE CENTRIFUGAL FANS (continued):

2.03 SOURCE QUALITY CONTROL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- B. AMCA Compliance: Fans shall comply with AMCA 11 and bear the AMCA-Certified Ratings Seal.
- C. Fan Sound Ratings: Comply with AMCA 311 and label fans with the AMCA-Certified Ratings Seal. Sound ratings shall comply with AMCA 301. The fans shall be tested according to AMCA 300.
- D. Fan Performance Ratings: Comply with AMCA 211 and label fans with AMCA-Certified Rating Seal. The fans shall be tested for air performance - flow rate, fan pressure, power, fan efficiency, air density, speed of rotation, and fan efficiency - according to AMCA 210/ASHRAE 51.
- E. Operating Limits: Classify fans according to AMCA 99.

PART 3 - EXECUTION

3.01 INSTALLATION OF CENTRIFUGAL HVAC FANS

- A. Install centrifugal fans level and plumb.
- B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.
- D. Equipment Mounting:
 - 1. Support duct-mounted and other hanging centrifugal fans directly from the building structure, using suitable hanging systems as specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
 - 2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- E. Install units with clearances for service and maintenance.
- F. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.02 DUCTWORK AND PIPING CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Install ducts adjacent to fans to allow service and maintenance.
- C. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

SECTION 233416.11 - SQUARE IN-LINE CENTRIFUGAL FANS (continued):

3.03 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
 - 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least **1/2 inch (13 mm)** high.

3.04 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring according to Section 250523 "Control-Voltage Electrical Power Cables."

3.05 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that there is adequate maintenance and access space.
 - 4. Verify that cleaning and adjusting are complete.
 - 5. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 6. Adjust belt tension.
 - 7. Adjust damper linkages for proper damper operation.
 - 8. Verify lubrication for bearings and other moving parts.
 - 9. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 10. See Section 230593 "Testing, Adjusting, and Balancing For HVAC" for testing, adjusting, and balancing procedures.
 - 11. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

SECTION 233416.11 - SQUARE IN-LINE CENTRIFUGAL FANS (continued):

3.06 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

3.07 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION 233416.11

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SECTION 233600 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Diffuser-type air terminal units.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of air terminal unit.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for air terminal units.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For air terminal units.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
 - 4. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

SECTION 233600 - AIR TERMINAL UNITS (continued):

- C. ASHRAE Compliance: Applicable requirements in ASHRAE/IES 90.1, "Section 6 - Heating, Ventilating, and Air Conditioning."

2.02 DIFFUSER-TYPE AIR TERMINAL UNITS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Acutherm; TF-HC or a comparable product by one of the following:
 - 1. Price Industries.
 - 2. Thermal Products, Corp.
 - 3. Titus.
- B. Configuration: Volume-damper, diffuser, and controller assembly.
- C. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
- D. Diffuser: Galvanized steel with white baked-enamel finish.
- E. Pressure Relief Bypass Rings (for use in non-ducted return air plenums): Galvanized steel with free moving shutter installed over diffuser inlet neck.
- F. Minimum Flow Stops: Factory installed, adjustable screw type for field adjustments to minimum airflow settings.
- G. Control Sequence: Diffusion dampers open and close to regulate airflow into the room in response to room temperature. The dampers are mechanically actuated by internal, factory-set thermal element thermostats, one for cooling and one for heating, with limited field adjustment.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 5, "Hangers and Supports" and with Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.02 TERMINAL UNIT INSTALLATION

- A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

SECTION 233600 - AIR TERMINAL UNITS (continued):

3.03 CONNECTIONS

- A. Comply with requirements in Section 233113.11 "Metal Ducts for General HVAC", 233113.13 "Metal Ducts for Laboratory Exhaust", and Section 233116 "Nonmetal Ducts" for connecting ducts to air terminal units.
- B. 233300 "Air Duct Accessories."
- C. IDENTIFICATION
- D. Label each air terminal unit with plan number, nominal air flow, and maximum and minimum factory-set air flows. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.
- E. FIELD QUALITY CONTROL
- F. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- G. Perform the following tests and inspections [with the assistance of a factory-authorized service representative]:
- H. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
- I. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leak exists.
- J. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- K. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.04 A DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 233600

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SECTION 233713.13 - AIR DIFFUSERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Rectangular and square ceiling diffusers.
- B. Related Requirements:
 - 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
 - 2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.04 INFORMATIONAL SUBMITTALS

- A. Source quality-control reports.

PART 2 - PRODUCTS

2.01 RECTANGULAR AND SQUARE CEILING DIFFUSERS

- A. **Basis-of-Design Product:** Subject to compliance with requirements, provide Price Industries; SPD or a comparable product by one of the following:
 - 1. Carnes Company.
 - 2. METALAIRE, Inc.
 - 3. Nailor Industries Inc.
 - 4. Titus.
 - 5. Tuttle & Bailey.

SECTION 233713.13 - AIR DIFFUSERS (continued):

- B. Devices shall be specifically designed for variable-air-volume flows.
- C. Material: Aluminum.
- D. Finish: Baked enamel, white.
- E. Face Size: 24 by 24 inches (600 by 600 mm).
- F. Face Style: Plaque.
- G. Pattern: Adjustable.
- H. Dampers: Radial opposed blade.
- I. Insulation: Factory applied, foil faced, R-6 insulation formed to fit contour of diffuser back, continuously glued and sealed around perimeter of outer cone to form vapor seal.
- J. Accessories:
 - 1. Equalizing grid.
 - 2. Plaster ring.
 - 3. Safety chain.
 - 4. Wire guard.
 - 5. Sectorizing baffles.
 - 6. Operating rod extension.

2.02 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install diffusers level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

SECTION 233713.13 - AIR DIFFUSERS (continued):

- C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.03 **ADJUSTING**

- A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.13

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SECTION 233713.23 - REGISTERS AND GRILLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Fixed face registers and grilles.
- B. Related Requirements:
 - 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
 - 2. Section 233713.13 "Air Diffusers" for various types of air diffusers.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.01 REGISTERS

- A. Fixed Face Register:
 - 1. **Basis-of-Design Product:** Subject to compliance with requirements, provide **Price Industries**; 630 (no filter) and 630FF (with filter) or a comparable product by one of the following:
 - a. **Carnes Company.**
 - b. **METALAIRE, Inc.**
 - c. **Nailor Industries Inc.**
 - d. **Titus.**
 - e. **Tuttle & Bailey.**
 - 2. Material: Aluminum.
 - 3. Finish: Baked enamel, white.
 - 4. Face Blade Arrangement: Vertical spaced **3/4 inch (19 mm)** apart.
 - 5. Core Construction: Removable.

SECTION 233713.23 - REGISTERS AND GRILLES (continued):

6. Frame: 1 inch (25 mm) wide.
7. Mounting: Countersunk screw.
8. Damper Type: Adjustable, aluminum, opposed blade.

2.02 GRILLES

A. Fixed Face Grille:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Price Industries; 630 (no filter) and 630FF (with filter) or a comparable product by one of the following:
 - a. Carnes Company.
 - b. METALAIRe, Inc.
 - c. Nailor Industries Inc.
 - d. Titus.
 - e. Tuttle & Bailey.
2. Material: Aluminum.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal; spaced 3/4 inch (19 mm) apart.
5. Core Construction: Removable.
6. Frame: 1 inch (25 mm) wide.
7. Mounting: Countersunk screw or Lay in, as required by ceiling type.

2.03 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install registers and grilles level and plumb.
- B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

SECTION 233713.23 - REGISTERS AND GRILLES (continued):

- C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.03 **ADJUSTING**

- A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

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SECTION 233919 - FIXED LOUVERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Fixed extruded-aluminum louvers.
 - 2. FEMA approved stationary blade louvers.

1.02 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).
- C. Vertical Louver: Louver with vertical blades (i.e., the axis of the blades are vertical).
- D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing in accordance with AMCA 550.
- F. Windborne-Debris-Impact-Resistant Louver: Louver that provides specified windborne-debris-impact resistance, as determined by testing in accordance with AMCA 540.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
 - 2. Show mullion profiles and locations.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed in accordance with AMCA 550 **and** AMCA 540 by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

SECTION 233919 - FIXED LOUVERS (continued):

1.05 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.06 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.07 WARRANTY

- A. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain fixed louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures are considered to act normal to the face of the building.
1. Wind Loads:
 - a. Determine loads based on pressures as indicated on Drawings.
- B. Windborne-Debris-Impact Resistance: Louvers located within 30 feet (9.1 m) of grade pass enhanced protection, when tested in accordance with AMCA 540.
- C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width in accordance with AMCA 550 **and AMCA 540**.

SECTION 233919 - FIXED LOUVERS (continued):

- D. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.03 FIXED EXTRUDED-ALUMINUM LOUVERS

- A. Vertical, Wind-Driven-Rain-Resistant, Windborne-Debris-Impact-Resistant Louver, Extruded Aluminum:
1. **Basis-of-Design Product:** Subject to compliance with requirements, provide Ruskin; EME6325 or a comparable product by one of the following:
 - a. Cesco Products; MESTEK, Inc.
 - b. Greenheck Fan Corporation.
 - c. Pottorff.
 2. Louver Depth: **6 inches (150 mm)**.
 3. Frame and Blade Nominal Thickness: Not less than **0.060 inch (1.52 mm)** for blades and **0.095 inch (2.41 mm)** for frames.
 4. Louver Performance Ratings:
 - a. Free Area: Not less than **6.0 sq.ft (0.55 sq. m)** for **48-inch- (1220-mm-)** wide by **48-inch- (1220-mm-)** high louver.
 - b. Air Performance: Not more than **0.18-inch wg (40-Pa)** static pressure drop at **1250-fpm (6.35-m/s)** free-area intake velocity.
 - c. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of **8 inches (200 mm)** per hour and a wind speed of **50 mph (22.4 m/s)** at a core-area intake velocity of **969 fpm (5.0 m/s)**.
 5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
 6. AMCA Rating: AMCA 540, AMCA 550.

2.04 FEMA APPROVED STATIONARY BLADE LOUVERS

- A. Horizontal, Chevron-Blade, Sight-Proof, FEMA 361 Louver:
1. **Basis-of-Design Product:** Subject to compliance with requirements, provide Ruskin; XP500 or comparable product by one of the following:
 - a. Air Balance Inc.; a Mestek company.
 - b. Arrow United Industries; a division of Mestek, Inc.
 - c. Greenheck Fan Corporation.
 - d. Pottorff.
 2. Louver Depth: **5 inches (125 mm)**.
 3. Frame and Blade Nominal Thickness: Not less than **0.25 inch (6 mm)**.
 4. Material: Aluminum.
 5. Louver Performance Ratings:
 - a. Free Area: 53 percent, nominal.
 - b. Air Performance: Not more than **0.25-inch wg** static pressure drop at **900-fpm (4.6-m/s)** free-area intake velocity.
 6. Design Windload:

SECTION 233919 - FIXED LOUVERS (continued):

- a. 300-psf: On units up to 78 inches (1981 mm) wide.
 - b. 250-psf: On units up to 90 inches (2286 mm) wide.
 - c. 200-psf: On units up to 96 inches (2438 mm) wide.
7. Louver shall comply with FEMA 361 Design and Construction for Community Shelters, Zone IV Criteria, 250 MPH wind, 15-lb, 2x4 impact at 100 mph.
- B. Horizontal, Chevron-Blade, Sight-Proof, Wind-Driven-Rain-Resistant, FEMA 361 Louver:
 1. **Basis-of-Design Product:** Subject to compliance with requirements, provide Ruskin; **XP500WD** or comparable product by one of the following:
 - a. Air Balance Inc.; a Mestek company.
 - b. Arrow United Industries; a division of Mestek, Inc.
 - c. Greenheck Fan Corporation.
 - d. Pottorff.
 2. Louver Depth: 5.5 inches.
 3. Frame and Blade Nominal Thickness: Not less than 0.1875 inches.
 4. Material: Aluminum.
 5. Louver Performance Ratings:
 - a. Free Area: 27 percent, nominal.
 - b. Air Performance: Not more than 0.12-inch wg static pressure drop at 900-fpm (4.6-m/s) free-area intake velocity.
 6. Louver shall comply with FEMA 361 Design and Construction for Community Shelters, Zone IV Criteria, 250 MPH wind, 15-lb, 2x4 impact at 100 mph.

2.05 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 1. Screen Location for Fixed Louvers: Interior face.
 2. Screening Type: Bird screening.
- B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
 2. Finish: Same finish as louver frames to which louver screens are attached.
 3. Type: Non-rewirable, U-shaped frames.
- D. Louver Screening for Aluminum Louvers:
 1. Bird Screening, Aluminum: 1/2-inch- (13-mm-) square mesh, 0.063-inch (1.60-mm) wire.

2.06 MATERIALS

- A. Aluminum Extrusions: **ASTM B221 (ASTM B221M)**, Alloy 6063-T5, T-52, or T6.

SECTION 233919 - FIXED LOUVERS (continued):

- B. Aluminum Sheet: **ASTM B209** (**ASTM B209M**), Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening aluminum, use aluminum or 300 series stainless steel fasteners.
 - 3. For fastening galvanized steel, use hot-dip-galvanized-steel or 300 series stainless steel fasteners.
 - 4. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless steel components, with allowable load or strength design capacities calculated in accordance with ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing in accordance with ASTM E488/E488M conducted by a qualified testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.07 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
 - 1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.
- C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: Exterior flange unless otherwise indicated.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or **72 inches** (**1830 mm**) o.c., whichever is less.
 - 1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
- G. Provide extended sills for recessed louvers.
- H. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

SECTION 233919 - FIXED LOUVERS (continued):

2.08 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
 - 2. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.03 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 for sealants applied during louver installation.

3.04 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

SECTION 233919 - FIXED LOUVERS (continued):

- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 233919

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SECTION 234100 - PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Pleated panel filters.

1.03 DEFINITIONS

- A. HIPS: High-impact polystyrene.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Provide one complete set(s) of filters for each filter bank. If system includes prefilters, provide only prefilters.

1.07 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An NRTL.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in a clean, dry place.

SECTION 234100 - PARTICULATE AIR FILTRATION (continued):

- B. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.
- C. Handle products carefully to prevent damage, breaking, denting, and scoring. Do not install damaged products.
- D. Protect products from weather, dirt, dust, water, construction debris, and physical damage.
 - 1. Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.
 - 2. Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remove coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.
 - 3. Replace installed products damaged during construction.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. ASHRAE Compliance:
 - 1. Comply with applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality"; Section 5 - "Systems and Equipment"; and Section 7 - "Construction and Startup."
 - 2. Comply with ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.
- B. Comply with NFPA 90A and NFPA 90B.
- C. Comply with UL 900.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 PLEATED PANEL FILTERS - STANDARD

- A. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames.
 - 1. **Basis-of-Design Product:** Subject to compliance with requirements, provide **Camfil**; AP-Thirteen or comparable product by one of the following:
 - a. **AAF / Flanders.**
 - b. **Airguard.**
 - c. **Purafil, Inc.**
- B. Source Limitations: Obtain from single source from single manufacturer.
- C. Capacities and Characteristics:
 - 1. Depth: **1 inch (25 mm)**, **2 inches (50 mm)**, or **4 inches (100 mm)** nominal, as indicated in Equipment Schedules.
 - 2. Maximum or Rated Face Velocity: **625 fpm (3.2 m/s)**.
 - 3. Initial Resistance: **0.25-inch wg (62 Pa)** at **350 fpm (1.8 m/s)**.
 - 4. Recommended Final Resistance: **1.0 inches wg (249 Pa)**.

SECTION 234100 - PARTICULATE AIR FILTRATION (continued):

- 5. Minimum Efficiency Reporting Value: MERV 13, with "Composite Average Particle Size Efficiency, Percent in Size Range, Micrometers" according to ASHRAE 52.2.
- D. Media: Interlaced glass or synthetic fibers coated with nonflammable adhesive.
 - 1. Separators shall be bonded to the media to maintain pleat configuration.
 - 2. Welded-wire grid shall be on downstream side to maintain pleat.
 - 3. Media shall be bonded to frame to prevent air bypass.
 - 4. Support members on upstream and downstream sides to maintain pleat spacing.
- E. Filter-Media Frame: Cardboard frame with perforated metal retainer sealed or bonded to the media.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine ducts, air-handling units, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF FILTERS

- A. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
- B. Install filters in position to prevent passage of unfiltered air.
- C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.
- D. Coordinate filter installations with duct and air-handling-unit installations.

3.03 FILTER SCHEDULE

- A. Indoor equipment with outside airflow less than 100 percent of supply airflow:
 - 1. Pleated panel filters - standard.

3.04 CLEANING

- A. After completing system installation and testing, adjusting, and balancing of air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION 234100

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SECTION 238126.11 - AIR-COOLED, SPLIT-SYSTEM AIR-CONDITIONERS (5 TONS AND SMALLER)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes small capacity, air-cooled, split-system air-conditioning and heat-pump units (5 tons and smaller) consisting of separate evaporator-fan and compressor-condenser components.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: One set(s) for each air-handling unit.

1.06 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
 - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

SECTION 238126.11 - AIR-COOLED, SPLIT-SYSTEM AIR-CONDITIONERS (5 TONS AND SMALLER) (continued):

2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

1.07 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 03.
- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
 1. Warranty Period:
 - a. For Compressor: Five year(s) from date of Substantial Completion.
 - b. For Parts: One year(s) from date of Substantial Completion.
 - c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. Carrier Corporation; a unit of United Technologies Corp.
 2. Daikin Industries, Ltd.
 3. Lennox Industries, Inc.; Lennox International.
 4. Mitsubishi Electric & Electronics USA, Inc.
 5. Trane.
 6. YORK; a Johnson Controls company.

2.02 INDOOR UNITS (5 TONS (18 kW) OR LESS)

- A. Floor-Mounted, Evaporator-Fan Components:
 1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Engineer.
 - a. Insulation: Faced, glass-fiber duct liner.
 - b. Drain Pans: Galvanized steel, with connection for drain; insulated.
 2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and electronic-expansion valve. Comply with ARI 206/110.

SECTION 238126.11 - AIR-COOLED, SPLIT-SYSTEM AIR-CONDITIONERS (5 TONS AND SMALLER) (continued):

3. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
 4. Fan: Direct drive, centrifugal.
 5. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
 6. Air Filtration Section:
 - a. General Requirements for Air Filtration Section:
 - 1) Comply with NFPA 90A.
 - 2) Comply with Section 234100 "Particulate Air Filtration" for filters
 - 3) Filter-Holding Frames: Arranged for flat or angular orientation. Filters shall be removable from one side.
 - b. Extended-Surface, Disposable Panel Filters:
 - 1) Factory-fabricated, dry, extended-surface type.
 - 2) Thickness: **1 inch (25 mm)**.
 - 3) Mounting Frames: Welded, galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.
- B. Wall-Mounted, Evaporator-Fan Components:
1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
 2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
 3. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
 4. Fan: Direct drive, centrifugal.
 5. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
 - c. Enclosure Type: Totally enclosed, fan cooled.
 - d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
 - e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
 - f. Mount unit-mounted disconnect switches on interior of unit.
 6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 7. Condensate Drain Pans:

SECTION 238126.11 - AIR-COOLED, SPLIT-SYSTEM AIR-CONDITIONERS (5 TONS AND SMALLER) (continued):

- a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
 - 2) Depth: A minimum of **1 inch (25 mm)** deep.
 - b. Single-wall, galvanized-steel sheet.
 - c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - 1) Minimum Connection Size: **NPS 3/4 (DN 19)**.
 - d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
8. Air Filtration Section:
- a. General Requirements for Air Filtration Section:
 - 1) Comply with NFPA 90A.
 - 2) Comply with Section 234100 "Particulate Air Filtration" for filters.
 - 3) Filter-Holding Frames: Arranged for flat. Filters shall be removable from one side.
 - b. Extended-Surface, Disposable Panel Filters:
 - 1) Factory-fabricated, dry, extended-surface type.
 - 2) Thickness: **1 inch (25 mm)**.
 - 3) Mounting Frames: Welded, galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

2.03 **OUTDOOR UNITS (5 TONS (18 kW) OR LESS)**

A. Air-Cooled, Compressor-Condenser Components (DSSO):

- 1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
- 2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - a. Compressor Type: Scroll.
 - b. Single-stage or two-stage compressor motor (as indicated on Drawings) with manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - c. Refrigerant: R-410A.
 - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
- 3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
- 4. Fan: Aluminum-propeller type, directly connected to motor.
- 5. Motor: Permanently lubricated, with integral thermal-overload protection.
- 6. Low Ambient Kit: Permits operation down to **45 deg F (7 deg C)**.

SECTION 238126.11 - AIR-COOLED, SPLIT-SYSTEM AIR-CONDITIONERS (5 TONS AND SMALLER) (continued):

B. Air-Cooled, Compressor-Condenser Components (HP):

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - a. Compressor Type: Inverter.
 - b. Compressor motor manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - c. Refrigerant: R-410A.
 - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Acrylonitrile-glass-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F (7 deg C).

2.04 ACCESSORIES

- A. Thermostat/Humidistat (AHUs): Low voltage with subbase to control compressor and evaporator fan. 7-day programmable combination thermostat/humidistat.
1. Compressor time delay.
 2. 24-hour time control of system stop and start.
 3. Liquid-crystal display indicating temperature, humidity, set-point temperature, set-point humidity, time setting, operating mode, and fan speed.
 4. Fan-speed selection including auto setting.
- B. Thermostat (DSSIs): Low voltage with subbase to control compressor and evaporator fan.
- C. Automatic-reset timer to prevent rapid cycling of compressor.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Equipment Mounting:
1. Install ground-mounted, compressor-condenser components on 4-inch (100-mm) cast-in-place concrete equipment base(s) that is 4 inches (100 mm) larger, on each side, than unit. Comply with requirements for equipment bases and foundations specified in Division 03.
 2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

SECTION 238126.11 - AIR-COOLED, SPLIT-SYSTEM AIR-CONDITIONERS (5 TONS AND SMALLER) (continued):

3.02 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.
- C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.04 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.

3.05 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126.11

SECTION 260100 - GENERAL PROVISIONS FOR ELECTRICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Provisions of this Section apply to all Division 26 Specification Sections.

1.02 SUMMARY

- A. Section includes basic requirements for electrical systems.
- B. Related Work:
 - 1. Division 02 – Existing Conditions
 - a. Refer to Division 02 for demolition and for abatement of hazardous materials.
 - b. Comply with the requirements of Division 02 for selective demolition.
 - 2. Division 03 – Concrete
 - a. Refer to Division 03 for rough grouting in and around work, patching concrete cut to accommodate work, and sumps for work.
 - b. Comply with the requirements of Division 03 for curbs, foundations, and equipment pads for equipment.
 - 3. Division 05 – Metals
 - a. Refer to Division 05 for framed openings for equipment.
 - b. Comply with the requirements of Division 05 for supports for work.
 - 4. Division 06 – Wood, Plastics, and Composites
 - a. Refer to Division 06 for framed openings for equipment.
 - 5. Division 07 – Thermal and Moisture Protection
 - a. Refer to Division 07 for installation of roof curbs and roof supports and for caulking and waterproofing of wall- and roof-mounted work.
 - b. Comply with the requirements of Division 07 for penetration firestopping and furnishing roof curbs and roof supports for equipment and conduit.
 - 6. Division 08 – Openings
 - a. Refer to Division 08 for installation of access doors and frames.
 - b. Comply with the requirements of Division 08 for access doors and frames, unless otherwise included in the Contract Documents.
 - 7. Division 09 – Finishes
 - a. Refer to Division 09 for paint products and applications in finished spaces.
 - b. Comply with the requirements of Division 09 for paint products and applications identified in the Contract Documents.
 - 8. Division 10 – Specialties

SECTION 260100 - GENERAL PROVISIONS FOR ELECTRICAL (continued):

- a. Refer to Division 10 for fire protection cabinets and fire extinguishers.
- 9. Division 21 – Fire Suppression
 - a. Refer to Division 21 for all suppression work.
- 10. Division 22 – Plumbing
 - a. Refer to Division 22 for all plumbing work.
 - b. Comply with requirements of Division 22 for related equipment and components and for connections to systems.
- 11. Division 23 – Heating, Ventilation, and Air-Conditioning
 - a. Refer to Division 23 for all heating, ventilation, and air-conditioning work.
 - b. Comply with requirements of Division 23 for related equipment and components and for connections to systems.
- 12. Division 25 – Instrumentation and Control
 - a. Refer to Division 25 for instrumentation and control systems.
 - b. Comply with the requirements of Division 25 for installation of and integration with instrumentation and control components.
- 13. Division 27 – Communications
 - a. Refer to Division 27 for all communications work.
- 14. Division 28 – Electronic Safety and Security
 - a. Refer to Division 28 for all electronic safety and security work.
 - b. Coordinate with Division 28 for integration with security systems.
- 15. Division 29 – Fire Safety and Emergency Communications
 - a. Refer to Division 29 for all fire safety and emergency communications work.
 - b. Coordinate with Division 29 for integration with fire safety and emergency communications systems.
- 16. Division 33 – Utilities
 - a. Refer to Division 33 for all utility related work greater than five feet outside the building, unless noted otherwise in the Contract Documents.
 - b. Comply with the requirements of Division 33 for utility work within five feet outside the building and otherwise as indicated in the Contract Documents.

1.03 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. Furnish: Supply and deliver to project site, ready for subsequent requirements.
- C. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.
- D. Provide: Furnish and install, complete and ready for intended use.

SECTION 260100 - GENERAL PROVISIONS FOR ELECTRICAL (continued):

- E. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- F. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.
- G. Concealed Work: Work hidden from view, including inside chases, furred spaces, or above ceilings.
- H. Exposed Work: Work open to view, including inside mechanical and equipment rooms.

1.04 QUALITY ASSURANCE

- A. General:
 - 1. It is the intent of the plans and specifications to obtain a complete, operable and satisfactory installation.
 - 2. All materials shall be new, be properly labeled and/or identified and be in full compliance with the contract documents.
 - 3. All work shall comply with applicable Codes and Standards.
 - 4. Manufacturer's model names and numbers used in these specifications are subject to change per manufacturer's action. Contractor shall therefore verify them with manufacturer's representative before ordering any product or equipment
- B. Furnish new and unused materials and equipment manufactured in the U.S.A. Where two or more units of the same type or class of equipment are required provide units of a single manufacturer.

1.05 CODES AND STANDARDS

- A. Perform work in accordance with the following codes and any applicable statutes, ordinances, codes, and regulations of governmental authorities having jurisdiction.
 - 1. ASHRAE
 - a. Standard 90.1 Energy Standard for Buildings Except Low Rise Residential Buildings
 - 2. Occupational Safety and Health Regulations (OSHA).
 - 3. National Fire Codes
 - a. NFPA 1 Uniform Fire Code – 2021 (Florida Edition)
 - b. NFPA 70 National Electrical Code – 2020
 - c. NFPA 72 National Fire Alarm and Signaling Code - 2019
 - d. NFPA 75 Standard for the Fire Protection of Information Technology Equipment – 2020
 - e. NFPA 101 Life Safety Code – 2021 (Florida Edition)
 - 4. Florida Building Code, 2023 Edition
 - a. Building Code
 - b. Existing Building Code
 - c. Energy Conservation Code
 - d. Mechanical Code
 - e. Plumbing Code
 - f. Fuel Gas Code

SECTION 260100 - GENERAL PROVISIONS FOR ELECTRICAL (continued):

- g. Accessibility Code
 - 5. 2023 ICC 500 (FEMA 361 5th Edition)
 - a. Chapter 1 Application And Administration
 - b. Chapter 6 Fire Safety
 - c. Chapter 7 Essential Features And Accessories
 - d. Chapter 8 Test Methods For Impact And Pressure Testing
 - 6. Florida Statutes
 - a. Chapter 471 Engineering
 - b. Chapter 533.80 Building Construction Standards; Florida Building Code - Enforcement
 - 7. Florida Administrative Code
 - a. Chapter 9B-7 Florida Building Commission Handicapped Accessibility Standards
 - b. Chapter 61G15-33 Responsibility Rules of Professional Engineers Concerning the Design of Electrical Systems
 - c. Chapter 69A-3 Fire Prevention – General Provisions
 - d. Chapter 69A-60 The Florida Fire Prevention Code
 - 8. ADA Accessibility Guidelines for Buildings (ADAAG)
- B. Resolve, in writing, any code violation discovered in contract documents with the Engineer prior to bidding. After award of the contract, make any correction or addition necessary for compliance with applicable codes at no additional cost to Owner.
- C. The Contractor shall include in the Work, without extra cost to the Owner, any labor, materials, services, apparatus, and drawings required to comply with all applicable laws, ordinances, rules, and regulations.
- D. Where there is conflict between the Contract Documents and the applicable Codes, the Codes shall govern, except where the requirements of the Contract Documents are more stringent.

1.06 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or NEC Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments, or supplements in effect on date bids are received. Specifications and standards are minimum requirements for all equipment, material and work. In instances where capacities, size or other feature of equipment, devices or materials exceed these minimums, meet listed or shown capacities.
- B. Whenever a reference is made to a standard, installation and materials shall comply with the latest published edition of the standard at the time project is bid unless otherwise specified herein

1.07 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.

1.08 PERMITS FEES AND INSPECTIONS

SECTION 260100 - GENERAL PROVISIONS FOR ELECTRICAL (continued):

- A. Obtain and pay for all permits, fees, tap fees, connection charges, demand charges, systems charges, impact fees, and inspections.
- B. Deliver all certificates of inspection issued by authorities having jurisdiction to the Engineer.

1.09 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for direction before proceeding.
 - 1. If discrepancies or conflicts occur between drawings, or between drawings and specifications, notify the Engineer in writing prior to bid date; however, the most stringent requirement shall govern.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.10 SUBMITTALS

- A. Submittals (including Product Data, Shop Drawings, and any other Action Submittal or Information Submittal) will only be reviewed if they are submitted in full accordance with the General and Supplementary Conditions, Division 01, and the following:
 - 1. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are approved by the Engineer.
 - 3. Submittals shall only contain relevant product data. Remove or strikeout irrelevant product data.
 - 4. Prepare submittals as PDF electronic files and electronically transmit to Engineer through email or web-based project software site, in accordance with Division 01 Specification Sections. Submittals shall be in searchable PDF format and not a scanned copy.
 - 5. Options: Identify options requiring selection by Engineer.
 - 6. Deviations: Clearly identify deviations from requirements in the Contract Documents, including minor variations and limitations.
 - 7. Revisions: Include relevant additional information and revisions, other than those specifically requested by Engineer on previous submittals. Indicate by highlighting on each submittal or noting on attached submittal sheet.
 - 8. Contractor's Review:
 - a. Submittals shall have been reviewed and approved by the General Contractor / Construction Manager. Include approval stamp, 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.
 - b. Engineer will not review submittals received from Contractor that do not have Contractor's review and approval.
 - 9. Electrical Modifications:

SECTION 260100 - GENERAL PROVISIONS FOR ELECTRICAL (continued):

- a. The electrical design indicated on the plans supports the Basis of Design specifications for the HVAC, plumbing, and fire-suppression systems at the time of design.
 - b. If HVAC, plumbing, or fire-suppression equipment is submitted with different electrical requirements, it is the responsibility of the Contractor to resolve all required electrical design changes, including, but not limited to: wire and conduit size, type or size of disconnect or overload protection, breaker coordination, point(s) of connection, etc. Any corrections required shall be provided at no additional cost.
 - c. Submittal shall clearly show the electrical design revisions with a written statement that this change will be provided at no additional cost. Submittals made with no written reference to the electrical design revisions will be presumed to work with the electrical design.
- B. Processing Time: Allow 15 days for submittal review. Time of review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of the failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. The Contractor shall not be relieved of responsibility for deviations from requirements of the contract documents by the Engineer's approval of shop drawings, product data, samples, or similar submittals unless the Contractor has specifically informed the Engineer in writing of such deviation at the time of submittal, and the Engineer has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in shop drawings, product data, samples, or similar submittals by the Engineer's approval thereof.
- D. Submittals on any particular phase of Work will receive only one review and one re-review (if required). If additional reviews are required beyond these two, the Contractor will be charged \$120.00 per hour for review time. This fee shall be paid to the Engineer prior to Submittal release.

1.11 SUBSTITUTIONS

- A. By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.
- B. Substitution Requests shall include, at a minimum:
1. Statement indicating why specified material, equipment, or installation method cannot be provided, if applicable.
 2. Coordination of information, including a list of changes and 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.
 3. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include an 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.
 4. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

SECTION 260100 - GENERAL PROVISIONS FOR ELECTRICAL (continued):

5. 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.
 6. Cost information, including a proposal of change, if any, in the Contract Sum.
 7. 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.
 8. 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.
- C. Procurement Substitution Requests submitted prior to receipt of bids will be received and considered by Owner when the following conditions are satisfied, as determined by Engineer; otherwise, requests will be returned without action:
1. Requests for substitution of materials and equipment are received no later than 10 days prior to date of bid opening.
 2. Extensive revisions to the Contract Documents are not required.
 3. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.
 4. The request is fully documented and properly submitted.
- D. Substitutions for Cause, as required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms will be received and considered by Engineer, only when the following conditions are satisfied; otherwise, requests will be returned without action, except to record noncompliance with these requirements:
1. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 2. Substitution request is fully documented and properly submitted.
 3. Requested substitution has received necessary approvals of authorities having jurisdiction.
 4. Requested substitution is compatible with other portions of the Work.
 5. Requested substitution has been coordinated with other portions of the Work.
 6. Requested substitution provides specified warranty.
 7. 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.
- E. Substitutions for Convenience, not required in order to meet other Project requirements but may offer advantage to Contractor or Owner, will be received and considered by Owner, as determined by Engineer, only when the following conditions are satisfied; otherwise, requests will be returned without action, except to record noncompliance with these requirements:
1. Requested substitution is received within 60 days after the Notice of Award.
 2. 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 Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 3. Requested substitution does not require extensive revisions to the Contract Documents.
 4. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 5. Substitution request is fully documented and properly submitted.
 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 7. Requested substitution is compatible with other portions of the Work.
 8. Requested substitution has been coordinated with other portions of the Work.

SECTION 260100 - GENERAL PROVISIONS FOR ELECTRICAL (continued):

9. Requested substitution provides specified warranty.
 10. 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.
- F. If a requested substitution is approved but contains differences or omissions not specifically identified to the attention of the Engineer in the substitution request, the Owner reserves the right to require equal or similar features to be added to the substituted products or to have the substituted products replaced at the Contractor's expense.

1.12 PROJECT RECORD DOCUMENTS

- A. Recording: Maintain one copy of the Contract Documents and Shop Drawings during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Preparation:
1. Contract Drawings and Shop Drawings:
 - a. Mark revisions to show where the actual installation varies from that shown originally.
 - b. Mark record sets completely and accurately, including important information that was either shown schematically or omitted from original Drawings.
 - c. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - d. Record underground and under-slab piping installed, dimensioning exact location and elevation of piping.
 2. Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 3. Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
- C. Deliver: Prior to Final Completion, provide record documents to Owner as indicated below:
1. Record Drawings: Submit PDF electronic files of scanned record prints and one set of prints.
 2. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
 3. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
 4. Miscellaneous Record Submittals: Submit annotated PDF electronic files directories of each submittal.

1.13 OPERATION AND MAINTENANCE MANUALS

- A. Prepare and submit a comprehensive manual of emergency, operation, and maintenance data and materials in full accordance with the General and Supplementary Conditions, Division 01, and the following:
1. Operations and Maintenance Manuals: Assemble a complete set of data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system, including:
 - a. Information required for daily operation and management, operating standards, and routine and special operating procedures.

SECTION 260100 - GENERAL PROVISIONS FOR ELECTRICAL (continued):

- b. Manufacturers' maintenance documentation, preventative maintenance procedures and frequency, repair procedures, wiring and systems diagrams, list of spare parts, and warranty information.
- 2. Submit manuals as PDF electronic files and electronically transmit to Engineer through email or web-based project software site, in accordance with Division 01 Specification Sections. Submittals shall be in searchable PDF format and not a scanned copy.

1.14 DEMONSTRATION AND TRAINING

- A. Prepare and provide services of qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not a part of a system in accordance with the General and Supplementary Conditions, Division 01, individual Specification Sections, and the following:
 - 1. Demonstration and training shall occur upon completion of the Work and at a time designated by the Owner's representative.
 - 2. Provide a high-resolution, digital video recording of each training session to the Owner.

1.15 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

1.16 WARRANTY

- A. Warranty work and equipment within specified warranty period. During the warranty period, provide labor and materials to make good any faults or imperfections that may arise due to defects or omissions in materials or workmanship without expense to the Owner.
 - 1. Warranty Period: One year from date of Substantial Completion.
- B. 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 Contract Documents.
- C. Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond nor relieving the Contractor of responsibilities during the warranty period.

PART 2 - EXECUTION

2.01 CONTRACT DOCUMENTS

- A. Examine all drawings and specifications carefully before submitting a bid. Architectural drawings take precedence over mechanical or electrical drawings with reference to building construction.
- B. For purposes of clearness and legibility, drawings are essentially diagrammatic and, although size and

SECTION 260100 - GENERAL PROVISIONS FOR ELECTRICAL (continued):

location of equipment are drawn to scale wherever possible, Contractor shall make use of all data in all of the contract documents and shall verify this information at the building site.

- C. The drawings indicate required size and points of termination of pipes, conduits, and ducts and suggest proper routes to conform to structure avoid obstructions and preserve clearances. However, it is not intended that drawings indicate all necessary offsets, and it shall be the responsibility of the Contractor to make the installation in such a manner as to conform to structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further instructions or cost to the Owner.
- D. Furnish, install and/or connect with appropriate services all items shown on any drawing without additional compensation.
- E. Any and all questions about a subcontractor's scope of work responsibility shall be addressed to and answered by the General Contractor / Construction Manager.
- F. Questions About Construction Documents: Any and all questions shall be submitted through the proper channels IN WRITING and, in turn, shall be answered by the Engineer in writing. All telephone conversations shall be considered unofficial and, as such, shall not be considered official or binding responses to Contractor's questions.
- G. Drawings, specifications, or other documents issued by the Engineer in electronic format and/or electronic media are provided for convenience only and are not intended for use as Contract Documents.
 - 1. The electronic files are provided merely as a convenience to the Recipient.
 - 2. The electronic files do not replace or supplement the paper copies of any drawings, specifications, or other documents included in the Contract Documents for use on the project.
 - 3. The Engineer makes no representation, warranty, or guarantee that electronic files:
 - a. Are suitable for any other usage or purpose.
 - b. Have any particular durability.
 - c. Will not damage or impair the Recipient's computer or software.
 - d. Contain no errors or mechanical flaws or other discrepancies that may render them unsuitable for the purpose intended by the Recipient.
 - 4. Due to the unsecured nature of the electronic files and the inability of Engineer or the Recipient to establish controls over their use, the Engineer assumes no responsibility for any consequences arising out of the use of the data. It is the sole responsibility of the Recipient to check the validity of all information contained therein. The Recipient shall at all times refer to the signed and sealed drawings, specification or other documents for the project during all phases of the project. The Recipient shall assume all risks and liabilities resulting from the use of the electronic files.

2.02 SUPERVISION OF WORK

- A. Perform all work under the direct supervision of an experienced, qualified superintendent. The Engineer has the right to remove a superintendent who, in the Engineer's opinion, is not satisfactory.

2.03 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, mechanical and electrical systems, and other construction affecting the Work.

SECTION 260100 - GENERAL PROVISIONS FOR ELECTRICAL (continued):

- 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.
 - 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. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

2.04 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, 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 caused by differing field conditions outside the control of Contractor, submit a request for information to Engineer.
- E. Interruption of Service: Before any existing equipment or system is shut down for disconnecting or tie-ins, coordinate with Engineer and Owner regarding acceptable dates and times for this Work to be performed. Work shall be performed at the time best suited for the Owner, which typically is either on weekends, holidays, and/or after normal working hours. Services shall be restored the same day unless prior arrangements are made. All overtime or premium costs associated with this Work shall be included in the Contractor's bid.

2.05 INSTALLATION

- A. Install materials and equipment in a professional manner. The Engineer may direct replacement of items which, in the Engineer's opinion, do not present a professional appearance or do not allow adequate space for maintenance. Replace or reinstall items at the expense of the Contractor.
- B. General: 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.

SECTION 260100 - GENERAL PROVISIONS FOR ELECTRICAL (continued):

4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.
- C. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- D. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- E. 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.
- F. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- G. Obstructions
 1. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
 2. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided. Verify locations given.
 3. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
 4. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.
- H. Where "rated" walls, floor, roofs and ceilings are penetrated or cut to install equipment, materials, devices, etc. the Contractor shall provide and install all materials required to re-establish the rating of the wall, floor, roof, or ceiling to the satisfaction of the authority having jurisdiction.
- I. Structural Elements: Do not cut structural elements without written approval from Engineer. Notify Engineer of locations and details of cutting and await directions from Engineer before proceeding. If approved by Engineer:
 1. Shore, brace, and support structural elements during cutting and patching.
 2. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
- J. Space Requirements: Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material which is not suitable in this respect.
- K. Tools and Equipment: Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions without cost to the Owner.
- L. Phasing: Provide all temporary valves, piping, ductwork, equipment, and devices as required. Maintain temporary services to areas as required. Remove all temporary material and equipment on completion of work unless Engineer concurs that such material and equipment would be beneficial to the Owner on a permanent basis.

SECTION 260100 - GENERAL PROVISIONS FOR ELECTRICAL (continued):

2.06 OWNER-INSTALLED PRODUCTS

- A. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

2.07 PROTECTION OF EXISTING FINISHES, CARPET, AND FURNISHING

- A. Protect existing finishes, carpet, casework, furnishing, and other building components against damage and soiling throughout construction activities. Take care during construction not to damage existing items. Contractor shall be responsible for replacing damaged material or restoring damaged materials to the Owner's satisfaction.
- B. When permitted by Engineer, items may be removed to a suitable, protected storage location during construction and cleaned and reinstalled in their original locations after construction operations are complete.
- C. Furniture may be relocated during construction and reinstalled in their original locations after construction operations are complete.
- D. Means and methods for protection are the responsibility of the Contractor. Utilize plywood, polyethylene sheeting, dust cloths, and other means as required.

2.08 UTILITY SERVICES AND ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

2.09 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Structural Elements: When cutting and patching structural elements, notify Engineer of locations and details of cutting and await directions from Engineer before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

SECTION 260100 - GENERAL PROVISIONS FOR ELECTRICAL (continued):

- F. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
- G. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety.
- H. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- I. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- J. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable or with in-place materials.
 - 1. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 2. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials.
- K. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

2.10 PAINTING

- A. Comply with requirements with General and Supplementary Conditions, Division 01, Division 09, and individual Specification Sections.
- B. Touch-up factory finishes on equipment provided under Division 26. Obtain matched color coatings from the manufacturer and apply as directed. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint, as required.

SECTION 260100 - GENERAL PROVISIONS FOR ELECTRICAL (continued):

- C. Paint the following work where exposed to view:
 - 1. Metal conduit
 - 2. Plastic conduit
- D. Paint the following work where exposed in occupied spaces:
 - 1. Other items as directed by Engineer.

2.11 REPAIR OF WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 2. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

2.12 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Tests
 - 1. Include all tests specified and/or required under laws, rules and regulations of all departments having jurisdiction. Tests shall also be performed as indicated herein and other sections of the specifications.
 - 2. After all systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation. Make adjustments as required to ensure proper functioning of all systems.
 - 3. All parts of the work and associated equipment shall be tested and adjusted to work properly and be left in perfect operating condition.
 - 4. Correct defects disclosed by these tests without any additional cost to the Owner. Repeat tests on repaired or replaced work.
 - 5. Maintain a log of all tests being conducted and have it available for review by the Engineer. Log to indicate date, type of tests, duration, and defects noted and when corrected.
 - 6. Special tests on individual systems are specified under individual Specification Sections.
- 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.

SECTION 260100 - GENERAL PROVISIONS FOR ELECTRICAL (continued):

2.13 CLEANING

- A. Progress Cleaning: 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 (27 deg C).
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Final 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. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - b. Remove labels that are not permanent.
 - c. Wipe surfaces of equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

2.14 MAINTENANCE SERVICE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of systems and equipment Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacture's authorized replacement parts and supplies.

END OF SECTION 260100

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Copper building wire.
2. Aluminum building wire.
3. Connectors and splices.

B. Related Requirements:

1. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

D. Conductor Insulation:

1. Type THHN and Type THWN-2: Comply with UL 83.

2.02 ALUMINUM BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn aluminum current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Standards:

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (continued):

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Aluminum, complying with ASTM B800 and ASTM B801.

D. Conductor Insulation:

1. Type THHN and Type THWN-2: Comply with UL 83.

2.03 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper or Aluminum to match wire.
2. Type: Two hole with long barrels.
3. Termination: Compression.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:

1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
2. Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors must be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:

1. Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

1. Emergency Feeders as defined by NEC 700: Emergency feeders within assembly occupancies shall be UL listed (FHJR) 2-hour rated, type MI within IMC or RSC raceways.

C. Branch Circuits: Type THHN/THWN-2, single conductors in raceway.

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (continued):

3.03 INSTALLATION, GENERAL

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- G. Feeders for emergency systems, as defined by NEC Article 700, shall not be routed above ceilings but instead below grade or within a space protected by an automatic sprinkler system.

3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inch (150 mm) of slack.

3.05 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.07 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 "Penetration Firestopping."

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (continued):

3.08 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
2. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - c. Inspect compression-applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable for a one-minute duration.
 - g. Continuity test on each conductor and cable.
 - h. Uniform resistance of parallel conductors.

B. Cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.
 - 2. Ground bonding common with lightning protection system.
 - 3. Foundation steel electrodes.

1.02 DEFINITIONS

- A. BCT: Bonding conductor for telecommunications.
- B. TGB: Telecommunications grounding busbar.
- C. TMGB: Telecommunications main grounding busbar.

1.03 ACTION SUBMITTALS

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

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.02 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
 - 1. Cable Tray Equipment Grounding Wire: No. 6 AWG.

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS (continued):

B. Cable Tray Grounding Jumper:

1. Not smaller than No. 6 AWG and not longer than **12 inches (300 mm)**. If jumper is a wire, it shall have a crimped grounding lug with two holes and long barrel for two crimps. If jumper is a flexible braid, it shall have a one-hole ferrule. Attach with grounding screw or connector provided by cable tray manufacturer.

C. Bare Copper Conductors:

1. Solid Conductors: ASTM B3.
2. Stranded Conductors: ASTM B8.
3. Tinned Conductors: ASTM B33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, **1/4 inch (6 mm)** in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; **1-5/8 inch (41 mm)** wide and **1/16 inch (1.6 mm)** thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; **1-5/8 inch (41 mm)** wide and **1/16 inch (1.6 mm)** thick.

D. PGB and TMGB Grounding Bus: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, **1/4 by 4 inches (6.3 by 100 mm) in cross section, length as indicated on Drawings. The busbar shall be NRTL listed for use as TMGB and shall comply with TIA-607-B.**

1. Predrilling shall be with holes for use with lugs specified in this Section.
2. Mounting Hardware: Stand-off brackets that provide a **4-inch (100-mm)** clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

E. TGB: Predrilled rectangular bars of hard-drawn solid copper, **1/4 by 2 inches (6.3 by 50 mm) in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with TIA-607-B.**

1. Predrilling shall be with holes for use with lugs specified in this Section.
2. Mounting Hardware: Stand-off brackets that provide at least a **2-inch (50-mm)** clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

2.03 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Mechanical-Type Bus-Bar Connectors: Cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS (continued):

- F. Conduit Hubs: Mechanical type, terminal with threaded hub.
- G. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- H. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- I. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.
- J. Busbar Connectors: Cast silicon bronze, solderless compression-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch (15.8- or 25.4-mm) centers for a two-bolt connection to the busbar.
- K. Straps: Solid copper, copper lugs. Rated for 600 A.
- L. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- M. Water Pipe Clamps:
 - 1. Mechanical type, two pieces with stainless steel bolts.
 - a. Material: Die-cast zinc alloy.
 - b. Listed for direct burial.
 - 2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

2.04 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 ft. (19 mm by 3 m).

PART 3 - EXECUTION

3.01 APPLICATIONS

- A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 30 inch (750 mm) below grade.
 - 2. Duct-Bank Grounding Conductor: Bury 12 inch (300 mm) above duct bank when indicated as part of duct-bank installation.
- C. Grounding Conductors: Green-colored insulation with continuous yellow stripe.
- D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus horizontally, on insulated spacers 2 inch (50 mm) minimum from wall, 6 inch (150 mm) above finished floor unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS (continued):

3. Stacking of conductors under a single bolt is not permitted when connecting to busbars.

E. Telecommunications Grounding:

1. The BCT between the TMGB and the ac service equipment ground shall not be smaller than No. 1/0 AWG.
2. Primary Protector: Bond to the TMGB with insulated bonding conductor.
3. Interconnections: Interconnect all TGBs with the TMGB with the telecommunications backbone conductor. If more than one TMGB is installed, interconnect TMGBs using the grounding equalizer conductor. The telecommunications backbone conductor and grounding equalizer conductor size shall not be less than 2 kcmils/linear foot (1 sq. mm/linear meter) of conductor length, up to a maximum size of No. 3/0 AWG unless otherwise indicated.
4. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each TGB and TMGB to the vertical steel of the building frame.
5. Electrical Power Panelboards: Where an electrical panelboard for telecommunications equipment is located in the same room or space, bond each TGB to the ground bar of the panelboard.

F. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors must be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.03 GROUNDING SEPARATELY DERIVED SYSTEMS

- A. Generator: Install grounding electrode(s) at the generator location. The electrode must be connected to the equipment grounding conductor and to the frame of the generator.
- B. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inch (150 mm) from the foundation.

3.04 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS (continued):

3.05 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are **2 inch (50 mm)** below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. Use exothermic welds for all below-grade connections.
 - 3. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and must be at least **12 inch (300 mm)** deep, with cover.
 - 1. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than **60 ft. (18 m)** apart.
- G. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building area or item indicated.
 - 1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
 - 2. Bury ground ring not less than **24 inch (600 mm)** from building's foundation.
- H. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least **20 ft. (6.0 m)** long. If reinforcing is in multiple pieces, connect together by the usual steel tie wires or exothermic welding to create the required length.
- I. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS (continued):

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.06 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Support, anchorage, and attachment components.
 - 2. Fabricated metal equipment support assemblies.

1.02 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum **13/32 inch (10 mm)** diameter holes at a maximum of **8 inch (200 mm)** on center in at least one surface.
 - 1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 2. Material for Channel, Fittings, and Accessories: Galvanized steel.
 - 3. Channel Width: **1-5/8 inch (41.25 mm)**.
 - 4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs must have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body must be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS (continued):

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, **Grade A325 (Grade A325M)**.
6. Toggle Bolts: All steel springhead type.
7. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.01 SELECTION

- A. Comply with the following standards for selection and installation of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 1. NECA NEIS 101
 2. NECA NEIS 105.
- B. Comply with requirements in Division 07 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."
- D. 260548.16 "Seismic Controls for Electrical Systems."]**
- E. **Maximum Support Spacing and Minimum Hanger Rod Size for Raceways:** Space supports for EMT, IMC, and ERMC as required by NFPA 70. Minimum rod size must be **1/4 inch (6 mm)** in diameter.
- F. **Multiple Raceways or Cables:** Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.02 INSTALLATION OF SUPPORTS

- A. Comply with NECA NEIS 101 for installation requirements except as specified in this article.
- B. **Strength of Support Assemblies:** Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination must be weight of supported components plus **200 lb (90 kg)**.

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS (continued):

- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete: Expansion anchor fasteners.
 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete **4 inch (100 mm)** thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than **4 inch (100 mm)** thick.
 6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 7. To Light Steel: Sheet metal screws.
 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M. Submit welding certificates.

3.04 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than **4 inch (100 mm)** larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use **3000 psi (20.7 MPa)**, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base as follows:
1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

- A. Touchup:

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS (continued):

1. Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - a. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Type EMT-S raceways and elbows.
2. Type ERM-C raceways, elbows, couplings, and nipples.
3. Type FMC-S raceways.
4. Type LFM-C raceways.
5. Type PVC raceways and fittings.
6. Fittings for conduit, tubing, and cable.
7. Threaded metal joint compound.
8. Surface metal raceways and fittings.
9. Wireways and auxiliary gutters.
10. Metallic outlet boxes, device boxes, rings, and covers.
11. Termination boxes.
12. Cabinets, cutout boxes, junction boxes, pull boxes, and miscellaneous enclosures.
13. Cover plates for device boxes.
14. Hoods for outlet boxes.
15. 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
16. Section 260519 "Low-Voltage for Electrical Power Conductors and Cables" for nonmetallic underground conduit with conductors (Type NUCC).

1.02 SACTION SUBMITTALS

A. Product Data: For the following:

1. Wireways and auxiliary gutters.
2. Cabinets, cutout boxes, and miscellaneous enclosures.

PART 2 - PRODUCTS

2.01 TYPE EMT-S RACEWAYS AND ELBOWS

A. Steel Electrical Metal Tubing (EMT-S) and Elbows:

1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 797 and UL Category Control Number FJMX.
 - 2) Material: Steel.

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS (continued):

- 3) Exterior Coating: Zinc.
- 4) Interior Coating: Zinc with organic top coating.

c. Options:

- 1) Minimum Trade Size: 1/2 inch (16 mm).
- 2) Colors: Critical operations power system (COPS) feeders: Orange.

2.02 TYPE ERM-C-S RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Galvanized-Steel Electrical Rigid Metal Conduit (ERM-C-S-G), Elbows, Couplings, and Nipples:

1. Applicable Standards:

- a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- b. General Characteristics:
 - 1) Reference Standards: UL 6 and UL Category Control Number DYIX.
 - 2) Exterior Coating: Zinc.
 - 3) Interior Coating: Zinc with organic top coating.

c. Options:

- 1) Minimum Trade Size: 3/4 inch (21 mm).
- 2) Colors: Critical operations power system (COPS) feeders: Orange.

2.03 TYPE FMC-S RACEWAYS

A. Steel Flexible Metal Conduit (FMC-S):

1. Applicable Standards:

- a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- b. General Characteristics:
 - 1) Reference Standard: UL 1 and UL Category Control Number DXUZ.
 - 2) Material: Steel.

c. Options:

- 1) Minimum Trade Size: 1/2 inch (16 mm).

2.04 TYPE LFMC RACEWAYS

A. Steel Liquidtight Flexible Metal Conduit (LFMC-S):

1. Applicable Standards:

- a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS (continued):

- b. General Characteristics:
 - 1) Reference Standard: UL 360 and UL Category Control Number DXHR.
 - 2) Material: Steel.
- c. Options:
 - 1) Minimum Trade Size: 1/2 inch (16 mm).

2.05 TYPE PVC RACEWAYS AND FITTINGS

A. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:

- 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 651 and UL Category Control Number DZYR.
 - 2) Dimensional Specifications: Schedule 40.
 - c. Options:
 - 1) Minimum Trade Size: 3/4 inch (21 mm).
 - 2) Markings: For use with maximum 90 deg C wire. For directional boring applications.

2.06 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Fittings for Type ERM, Type IMC, Type PVC, Type EPEC, and Type RTRC Raceways:

- 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514B and UL Category Control Number DWTT.
 - 2) Material: Steel.
 - 3) Coupling Method: Compression coupling.
 - c. Options:
 - 1) Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
 - 2) Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

B. Fittings for Type EMT Raceways:

- 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS (continued):

- b. General Characteristics:
 - 1) Reference Standards: UL 514B and UL Category Control Number FKAV.
 - 2) Material: Steel.
 - 3) Coupling Method: Compression coupling.
- c. Options:
 - 1) Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
 - 2) Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.
- C. Fittings for Type FMC Raceways:
 - 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514B and UL Category Control Number ILNR.
- D. Fittings for Type LFMC Raceways:
 - 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514B and UL Category Control Number DXAS.

2.07 **ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT**

- A. Applicable Standards:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and approved by authorities having jurisdiction for application to threaded conduit assemblies.
 - 2. General Characteristics:
 - a. Reference Standards: UL 2419 and UL Category Control Number FOIZ.

2.08 **SURFACE METAL RACEWAYS AND FITTINGS**

- A. Surface Metal Raceways and Fittings with Metal Covers:
 - 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 5 and UL Category Control Number RJBT.

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS (continued):

c. Options:

- 1) Aluminum base with snap-on covers.
- 2) Manufacturer's standard enamel finish in color selected by Architect.
- 3) Wiring Channels: Dual. Multiple channels must be capable of housing a standard 20 to 30 A NEMA device flush within the raceway.

2.09 WIREWAYS AND AUXILIARY GUTTERS

A. Metal Wireways and Auxiliary Gutters:

1. Applicable Standards:

- a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- b. General Characteristics:

- 1) Reference Standards: UL 870 and UL Category Control Number ZOYX.
- 2) Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- 3) Finish: Manufacturer's standard enamel finish.

c. Options:

- 1) Degree of Protection: Type 1 inside; Type 3R outside unless otherwise indicated.
- 2) Wireway Covers: Screw-cover type unless otherwise indicated.

2.10 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Metallic Outlet Boxes:

1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
2. Applicable Standards:

- a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- b. General Characteristics:

- 1) Reference Standards: UL 514A and UL Category Control Number QCIT.

c. Options:

- 1) Material: Sheet steel.
- 2) Sheet Metal Depth: Minimum 2.5 inch (65 mm).
- 3) Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing up to 50 lb (23 kg).
- 4) Paddle Fan Outlet Boxes and Covers: Nonadjustable, designed for attachment of paddle fan weighing up to 70 lb (32 kg).

B. Metallic Conduit Bodies:

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS (continued):

1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514A and UL Category Control Number QCIT.

C. Metallic Device Boxes:

1. Description: Box with provisions for mounting wiring device directly to box.
2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514A and UL Category Control Number QCIT.
 - c. Options:
 - 1) Material: Sheet steel.
 - 2) Sheet Metal Depth: minimum 2.5 inch (65 mm).
 - 3) Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing up to 50 lb (23 kg).
 - 4) Paddle Fan Outlet Boxes and Covers: Nonadjustable, designed for attachment of paddle fan weighing up to 70 lb (32 kg).

D. Metallic Extension Rings:

1. Description: Ring intended to extend sides of outlet box or device box to increase box depth, volume, or both.
2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514A and UL Category Control Number QCIT.

E. Metallic Concrete Boxes and Covers:

1. Description: Box intended for use in poured concrete.
2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514A and UL Category Control Number QCIT.

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS (continued):

2.11 TERMINATION BOXES

- A. Description: Enclosure for termination base consisting of lengths of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors or both.
- B. Termination Boxes and Termination Bases for Installation on Line Side of Service Equipment:
 - 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 1773 and UL Category Control Number XCKT.
 - 2) Listed and labeled for installation on line side of service equipment.
- C. Termination Boxes and Termination Bases for Installation on Load Side of Service Equipment:
 - 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 1773 and UL Category Control Number XCKT.
 - 2) Listed and labeled for installation on load side of service equipment.

2.12 CABINETS, CUTOUT BOXES, JUNCTION BOXES, PULL BOXES, AND MISCELLANEOUS ENCLOSURES

- A. Indoor Sheet Metal Cabinets:
 - 1. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.
 - 2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL Category Control Number CYIV.
 - a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) Degree of Protection: Type 1.
- B. Indoor Sheet Metal Junction and Pull Boxes:
 - 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - 2. Applicable Standards:

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS (continued):

- a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL Category Control Number BGUZ.
 - a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) Degree of Protection: Type 1.
- C. Indoor Sheet Metal Miscellaneous Enclosures:
- 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards:
 - a) UL 1773 and UL Category Control Number XCKT.
 - b) Non-Environmental Characteristics: UL 50.
 - c) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) Degree of Protection: Type 1.
- D. Outdoor Sheet Metal Cabinets:
- 1. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.
 - 2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL Category Control Number CYIV.
 - a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) Degree of Protection: Type 3R.
- E. Outdoor Sheet Metal Junction and Pull Boxes:
- 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - 2. Applicable Standards:

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS (continued):

- a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- b. General Characteristics:
 - 1) Reference Standards: UL Category Control Number BGUZ.
 - a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.
- c. Options:
 - 1) Degree of Protection: Type 3R.

F. Outdoor Sheet Metal Miscellaneous Enclosures:

- 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards:
 - a) UL 1773 and UL Category Control Number XCKT.
 - b) Non-Environmental Characteristics: UL 50.
 - c) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) Degree of Protection: Type 3R.

2.13 COVER PLATES FOR DEVICES BOXES

A. Metallic Cover Plates for Device Boxes:

- 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514D and UL Category Control Numbers QCIT and QCMZ.
 - 2) Wallplate-Securing Screws: Metal with head color to match wall plate finish.
 - c. Options:
 - 1) Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
 - 2) Wallplate Material: **0.032 inch (0.8 mm)** thick Type 302/304 non-magnetic stainless steel with brushed finish.

B. Nonmetallic Cover Plates for Device Boxes:

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS (continued):

1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514D and UL Category Control Numbers QCIT and QCMZ.
 - 2) Wallplate-Securing Screws: Metal with head color to match wall plate finish.
 - c. Options:
 - 1) Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
 - 2) Wallplate Material: 0.060 inch (1.5 mm) thick high-impact thermoplastic (nylon) with smooth finish and color matching wiring device.
 - 3) Color: White.

2.14 HOODS FOR OUTLET BOXES

- A. Extra-Duty, While-in-Use Hoods for Outlet Boxes:
 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514D and UL Category Control Numbers QCIT and QCMZ.
 - 2) Marked "Extra-Duty" in accordance with UL 514D.
 - 3) Receptacle, hood, cover plate, gaskets, and seals comply with UL 498 Supplement SA when mated with box or enclosure complying with UL 514A, UL 514C, or UL 50E.
 - 4) Mounts to box using fasteners different from wiring device.
 - c. Options:
 - 1) Provides clear, weatherproof, "while-in-use" cover.
 - 2) Manufacturer may combine nonmetallic device box with hood as extra-duty rated assembly.

PART 3 - EXECUTION

3.01 SELECTION OF RACEWAYS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.
- B. Outdoors:
 1. Exposed Conduit: ERMCM.

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS (continued):

2. Concealed Conduit, Aboveground: ERM C.
3. Direct-Buried Conduit: PVC-40.
4. Concrete-Encased Conduit Not in Trench: PVC-40.
5. Concrete-Encased Conduit in Trench: PVC-40.
6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

C. Indoors:

1. Hazardous Classified Locations: ERM C.
2. Exposed and Subject to Physical Damage: ERM C. Raceway locations include the following:
 - a. Mechanical rooms.
3. Exposed, Not Subject to Physical Damage: EMT.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Damp or Wet Locations: ERM C.
6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC.

D. Stub-ups to Above Recessed Ceilings: Provide EMT, IMC, or ERM C for raceways.

E. Raceway Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.

1. ERM C and IMC: Provide threaded type fittings unless otherwise indicated.

3.02 SELECTION OF BOXES AND ENCLOSURES

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.

B. Degree of Protection:

1. Outdoors:
 - a. Type 3R unless otherwise indicated.
2. Indoors:
 - a. Type 1 unless otherwise indicated.

C. Exposed Boxes Installed Less Than 6.5 ft. (2 m) Above Floor:

1. Provide exposed cover. Flat covers with angled mounting slots or knockouts are prohibited.

3.03 INSTALLATION OF RACEWAYS

A. Installation Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Architect for resolution of conflicting requirements.
2. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS (continued):

3. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
4. Comply with NECA NEIS 101 for installation of steel raceways.
5. Comply with NECA NEIS 111 for installation of nonmetallic raceways.
6. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
7. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to **1-1/4 inch (35 mm)** trade size and insulated throat metal bushings on **1-1/2 inch (41 mm)** trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
8. Raceway Terminations at Locations Subject to Moisture or Vibration:
 - a. Provide insulating bushings to protect conductors, including conductors smaller than No. 4 AWG. Install insulated throat metal grounding bushings on service conduits.

B. General Requirements for Installation of Raceways:

1. Complete raceway installation before starting conductor installation.
2. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of **2 ft. (0.6 m)** above finished floor.
3. Install no more than equivalent of three 90-degree bends in conduit run. Support within **12 inch (300 mm)** of changes in direction.
4. Make bends in raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
5. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
6. Support conduit within **12 inch (300 mm)** of enclosures to which attached.
7. Install raceway sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings in accordance with NFPA 70.
8. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of raceways at the following points:
 - a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - b. Where an underground service raceway enters a building or structure.
 - c. Conduit extending from interior to exterior of building.
 - d. Conduit extending into pressurized duct and equipment.
 - e. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
 - f. Where otherwise required by NFPA 70.
9. Do not install conduits within **2 inch (50 mm)** of the bottom side of a metal deck roof.
10. Keep raceways at least **6 inch (150 mm)** away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
11. Cut conduit perpendicular to the length. For conduits **2 inch (53 mm)** trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
12. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than **200 lb (90 kg)** tensile strength. Leave at least **12 inch (300 mm)** of slack at both ends of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS (continued):

C. Requirements for Installation of Specific Raceway Types:

1. Types ERM and IMC:
 - a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
2. Types FMC, LFMC, and LFNC:
 - a. Comply with NEMA RV 3. Provide a maximum of 72 inch (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
3. Types PVC and EPEC:
 - a. Do not install Type PVC or Type EPEC conduit where ambient temperature exceeds 122 deg F (50 deg C). Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete encasement, where 90 deg C conductors are permitted.
 - b. Comply with manufacturer's written instructions for solvent welding and fittings.

D. Raceways Embedded in Slabs:

1. Run raceways larger than 1 inch (25 mm) trade size below concrete slab..
2. Arrange raceways to cross building expansion joints with expansion fittings at right angles to the joint.
3. Arrange raceways to ensure that each is surrounded by a minimum of 1 inch (25 mm) of concrete without voids.
4. Do not embed threadless fittings in concrete unless locations have been specifically approved by Architect.
5. Change from ENT to ERM before rising above floor.

E. Stub-ups to Above Recessed Ceilings:

1. Provide EMT, IMC, or ERM for raceways.
2. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

F. Raceway Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.

1. EMT: Provide compression, steel fittings. Comply with NEMA FB 2.10.
2. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.

G. Expansion-Joint Fittings:

1. Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg F (17 deg C) and that have straight-run length that exceeds 25 ft. (7.6 m). Install in runs of aboveground ERM and EMT conduit that are located where environmental temperature change may exceed 100 deg F (55 deg C) and that have straight-run length that exceeds 100 ft. (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for the following locations:

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS (continued):

- a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - d. Attics: 135 deg F (75 deg C) temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
 4. Install expansion fittings at locations where conduits cross building or structure expansion joints.
 5. Install expansion-joint fitting with position, mounting, and piston setting selected in accordance with manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

H. Raceways Penetrating Rooms or Walls with Acoustical Requirements:

1. Seal raceway openings on both sides of rooms or walls with acoustically rated putty or firestopping.

3.04 INSTALLATION OF SURFACE RACEWAYS

- A. Install surface raceways only where indicated on Drawings.
- B. Install surface raceway with a minimum 2 inch (50 mm) radius control at bend points.
- C. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inch (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway in accordance with manufacturer's written instructions. Tape and glue are unacceptable support methods.

3.05 INSTALLATION OF BOXES AND ENCLOSURES

- A. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
- B. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- C. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
- D. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- E. Locate boxes so that cover or plate will not span different building finishes.
- F. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS (continued):

- G. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
- H. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
- I. Set metal floor boxes level and flush with finished floor surface.
- J. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- K. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.
- L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
- M. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:
 - 1. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
 - 2. Provide gaskets for wallplates and covers.

3.06 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Division 07 "Penetration Firestopping."

3.07 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

3.08 CLEANING

- A. Boxes: Remove construction dust and debris from device boxes, outlet boxes, and floor-mounted enclosures before installing wallplates, covers, and hoods.

END OF SECTION 260533

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SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Round sleeves.
2. Rectangular sleeves.
3. Sleeve seal systems.
4. Grout.
5. 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
6. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

PART 2 - PRODUCTS

2.01 ROUND SLEEVES

A. Wall Sleeves, Steel:

1. Description: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.

2.02 RECTANGULAR SLEEVES

A. Sheet Metal Sleeves, Galvanized Steel, Rectangular:

1. Description:
 - a. Material: Galvanized sheet steel.
 - b. Minimum Metal Thickness:
 - 1) For sleeve cross-section rectangle perimeter less than 50 inch (1270 mm) and with no side larger than 16 inch (400 mm), thickness must be 0.052 inch (1.3 mm).
 - 2) For sleeve cross-section rectangle perimeter not less than 50 inch (1270 mm) or with one or more sides larger than 16 inch (400 mm), thickness must be 0.138 inch (3.5 mm).

2.03 SLEEVE SEAL SYSTEMS

- ##### **A. Description:** Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable or between raceway and cable.

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING
(continued):

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.04 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
 2. Design Mix: 5000 psi (34.5 MPa), 28-day compressive strength.
 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:
1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - b. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 "Joint Sealants."
 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 3. Size pipe sleeves to provide 1/4 inch (6.4 mm) annular clear space between sleeve and raceway or cable, unless sleeve seal system is to be installed.
 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
- B. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- C. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seal systems. Size sleeves to allow for 1 inch (25 mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.02 INSTALLATION OF RECTANGULAR SLEEVES AND SLEEVE SEALS

- A. Install sleeves in existing walls without compromising structural integrity of walls. Do not cut structural elements without reinforcing the wall to maintain the designed weight bearing and wall stiffness.

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING
(continued):

- B. Install conduits and cable with no crossings within the sleeve.
- C. Fill opening around conduits and cables with expanding foam without leaving voids.
- D. Provide metal sheet covering at both wall surfaces and finish to match surrounding surfaces. Metal sheet must be same material as sleeve.

3.03 **INSTALLATION OF SLEEVE SEAL SYSTEMS**

- A. Install sleeve seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 260544

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SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Color and legend requirements for raceways, conductors, and warning labels and signs.
 - 2. Labels.
 - 3. Tapes and stencils.
 - 4. Signs.
 - 5. Paint for identification.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Comply with NFPA 70E requirements for arc-flash warning labels.
- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

2.02 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS (continued):

2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 4. Color for Neutral: White or gray.
 5. Color for Equipment Grounds: Green.
- C. Raceways and Cables Carrying Circuits at More Than 600 V:
1. Black letters on an orange field.
 2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."
- D. Warning Label Colors:
1. Identify system voltage with black letters on an orange background.
- E. Warning labels and signs shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
- F. Equipment Identification Labels:
1. Black letters on a white field.
- 2.03 **LABELS**
- A. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, vinyl flexible label with acrylic pressure-sensitive adhesive.
- B. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
1. Minimum Nominal Size:
 - a. 1-1/2 by 6 inches (37 by 150 mm) for raceway and conductors.
 - b. 3-1/2 by 5 inches (76 by 127 mm) for equipment.
 - c. As required by authorities having jurisdiction.

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS (continued):

2.04 TAPES AND STENCILS

- A. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.
- B. Tape and Stencil: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers placed diagonally over orange background and are 12 inches (300 mm) wide. Stop stripes at legends.
- C. Floor Marking Tape: 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
- D. Underground-Line Warning Tape:
 - 1. Tape:
 - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
 - 2. Color and Printing:
 - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
 - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
 - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".
 - 3. Tag:
 - a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, compounded for direct-burial service.
 - b. Width: 3 inches (75 mm).
 - c. Overall Thickness: 5 mils (0.125 mm).
 - d. Foil Core Thickness: 0.35 mil (0.00889 mm).
 - e. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
 - f. Tensile according to ASTM D 882: 70 lbf (311.3 N) and 4600 psi (31.7 MPa).

2.05 SIGNS

- A. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Engraved legend.
 - 2. Thickness:
 - a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
 - b. For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.
 - c. Engraved legend with black letters on white face.
 - d. Punched or drilled for mechanical fasteners with 1/4-inch (6.4-mm) grommets in corners for mounting.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS (continued):

2.06 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.02 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum **3/8-inch- (10-mm-)** high letters for emergency instructions at equipment used for power transfer.

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS (continued):

- K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- L. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- M. Self-Adhesive Labels:
 - 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide a single line of text with **1/2-inch- (13-mm-)** high letters on **1-1/2-inch- (38-mm-)** high label; where two lines of text are required, use labels **2 inches (50 mm)** high.
- N. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
 - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of **6 inches (150 mm)** where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- O. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- P. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- Q. Underground Line Warning Tape:
 - 1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at **6 to 8 inches (150 to 200 mm)** below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds **16 inches (400 mm)** overall.
 - 2. Limit use of underground-line warning tape to direct-buried cables.
 - 3. Install underground-line warning tape for direct-buried cables and cables in raceways.
- R. Nonmetallic Preprinted Tags:
 - 1. Place in a location with high visibility and accessibility.
 - 2. Secure using UV-stabilized cable ties.
- S. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a single line of text with **1/2-inch- (13-mm-)** high letters on **1-1/2-inch- (38-mm-)** high sign; where two lines of text are required, use labels **2 inches (50 mm)** high.

3.03 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS (continued):

- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Concealed Raceways, Duct Banks, more than 600 V, within Buildings: Tape and stencil. Stencil legend "DANGER - CONCEALED HIGH-VOLTAGE WIRING" with 3-inch- (75-mm-) high, black letters on 20-inch (500-mm) centers.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, and at 10-foot (3-m) maximum intervals.
- D. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Self-adhesive labels.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- E. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 50 A and 120 V to Ground: Identify with self-adhesive wraparound labels.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- F. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive vinyl tape to identify the phase.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- G. Power-Circuit Conductor Identification, More Than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and a separate tag with the circuit designation.
- H. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.
- I. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with the conductor designation.
- J. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- K. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- L. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- M. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS (continued):

- N. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.
 - 1. Apply to exterior of door, cover, or other access.
 - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Power-transfer switches.
 - b. Controls with external control power connections.
- O. Arc Flash Warning Labeling: Self-adhesive labels.
- P. Operating Instruction Signs: Self-adhesive labels.
- Q. Emergency Operating Instruction Signs: Self-adhesive labels with white legend on a red background with minimum ~~3/8-inch-~~ (10-mm-) high letters for emergency instructions at equipment used for power transfer.
- R. Equipment Identification Labels:
 - 1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
 - 2. Outdoor Equipment: Laminated acrylic or melamine sign.
 - 3. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Switchboards.
 - e. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - f. Emergency system boxes and enclosures.
 - g. Enclosed switches.
 - h. Variable-speed controllers.
 - i. Power-transfer equipment.
 - j. Contactors.
 - k. Battery-inverter units.
 - l. Battery racks.
 - m. Power-generating units.
 - n. Monitoring and control equipment.
 - o. UPS equipment.

END OF SECTION 260553

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SECTION 262213 - LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
 - 2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: On receipt, inspect for and note any shipping damage to packaging and transformer.
 - 1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.
- B. Storage: Store in a warm, dry, and temperature-stable location in original shipping packaging.
- C. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton.
 - 2. Siemens Industry, Inc., Energy Management Division.
 - 3. Square D; Schneider Electric USA.
 - 4. ABB Inc
- B. Source Limitations: Obtain each transformer type from single source from single manufacturer.

SECTION 262213 - LOW-VOLTAGE DISTRIBUTION TRANSFORMERS (continued):

2.02 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Comply with NFPA 70.
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- C. Transformers Rated 15 kVA and Larger:
 - 1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
 - 2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.

2.03 DISTRIBUTION TRANSFORMERS

- A. Comply with NFPA 70, and list and label as complying with UL 1561.
- B. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.
 - 1. One leg per phase.
 - 2. Core volume shall allow efficient transformer operation at 10 percent above the nominal tap voltage.
 - 3. Grounded to enclosure.
- C. Coils: Continuous windings without splices except for taps.
 - 1. Coil Material: Aluminum.
 - 2. Internal Coil Connections: Brazed or pressure type.
 - 3. Terminal Connections: Bolted.
- D. Encapsulation: Transformers smaller than 30 kVA shall have core and coils completely resin encapsulated.
- E. Indoor Enclosure: Ventilated.
 - 1. NEMA 250, Type 2: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
 - 2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
 - 3. Wiring Compartment: Sized for conduit entry and wiring installation.
 - 4. Finish: Comply with NEMA 250.
- F. Taps for Transformers 15 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.
- G. Insulation Class, 15 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 80 deg C rise above 40 deg C ambient temperature.
- H. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.
- I. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.

SECTION 262213 - LOW-VOLTAGE DISTRIBUTION TRANSFORMERS (continued):

1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor, without exceeding the indicated insulation class in a 40 deg C maximum ambient and a 24-hour average ambient of 30 deg C.
 2. Indicate value of K-factor on transformer nameplate.
 3. Unit shall comply with requirements of DOE 2016 efficiency levels when tested according to NEMA TP 2 with a K-factor equal to one.
- J. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
 2. Include special terminal for grounding the shield.
- K. Neutral: Rated 200 percent of full load current for K-factor-rated transformers.

2.04 IDENTIFICATION

- A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.

SECTION 262213 - LOW-VOLTAGE DISTRIBUTION TRANSFORMERS (continued):

- B. Construct concrete bases according to Section 033000 "Cast-in-Place Concrete" and anchor floor-mounted transformers according to manufacturer's written instructions and requirements in Section 260529 "Hangers and Supports for Electrical Systems."
 - 1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- C. Secure transformer to concrete base according to manufacturer's written instructions.
- D. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.
- E. Remove shipping bolts, blocking, and wedges.

3.03 CONNECTIONS

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.04 FIELD QUALITY CONTROL

- A. Perform tests and inspections with the assistance of a factory-authorized service representative.
- B. Dry-Type Transformer Field Tests:
 - 1. Visual and Mechanical Inspection.
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, and grounding.
 - c. Verify that resilient mounts are free and that any shipping brackets have been removed.
 - d. Verify the unit is clean.
 - e. Perform specific inspections and mechanical tests recommended by manufacturer.
 - f. Verify that as-left tap connections are as specified.
 - g. Verify the presence of surge arresters and that their ratings are as specified.
 - 2. Electrical Tests:
 - a. Measure resistance at each winding, tap, and bolted connection.
 - b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.
 - c. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.

SECTION 262213 - LOW-VOLTAGE DISTRIBUTION TRANSFORMERS (continued):

- d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- C. Remove and replace units that do not pass tests or inspections and retest as specified above.
- D. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.05 **ADJUSTING**

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.06 **CLEANING**

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262213

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SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.

1.03 DEFINITIONS

- A. ATS: Acceptance testing specification.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. HID: High-intensity discharge.
- E. MCCB: Molded-case circuit breaker.
- F. SPD: Surge protective device.
- G. VPR: Voltage protection rating.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
 - 1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
 - 2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. Include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

SECTION 262416 - PANELBOARDS (continued):

2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Keys: Two spares for each type of panelboard cabinet lock.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards.
- B. Handle and prepare panelboards for installation according to NECA 407 and NEMA PB 1.

1.09 FIELD CONDITIONS

- A. Environmental Limitations:
 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry and work above panelboards is complete. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding **minus 22 deg F (minus 30 deg C)** to **plus 104 deg F (plus 40 deg C)**.
 - b. Altitude: Not exceeding **6600 feet (2000 m)**.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 1. Ambient temperatures within limits specified.
 2. Altitude not exceeding **6600 feet (2000 m)**.
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 1. Notify Owner no fewer than 5 days in advance of proposed interruption of electric service.
 2. Do not proceed with interruption of electric service without Owner's written permission.
 3. Comply with NFPA 70E.

1.10 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

SECTION 262416 - PANELBOARDS (continued):

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PANELBOARDS COMMON REQUIREMENTS

- A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.
- E. Enclosures: Flush and Surface-mounted, dead-front cabinets.
 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 2. Height: 84 inches (2.13 m) maximum.
 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
 4. Finishes:
 - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
- F. Incoming Mains:
 1. Location: As indicated on plans.
 2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.
- G. Phase, Neutral, and Ground Buses:
 1. Material: Hard-drawn copper, 98 percent conductivity.
 - a. Bus shall be fully rated the entire length.
 2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

SECTION 262416 - PANELBOARDS (continued):

- H. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Terminations shall allow use of 75 deg C rated conductors without derating.
 - 3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
 - 4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
 - 5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
 - 6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- I. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
- J. Future Devices: Panelboards or shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
 - 1. Percentage of Future Space Capacity: 20 percent.
- K. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
 - 1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
 - 2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.02 POWER PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton.
 - 2. SIEMENS Industry, Inc.; Energy Management Division.
 - 3. Square D; by Schneider Electric.
 - 4. ABB Inc
- B. Panelboards: NEMA PB 1, distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 - 1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.
- D. Mains: Circuit breaker, Fused switch or Lugs only as indicated.
- E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers or fused switches as indicated.

SECTION 262416 - PANELBOARDS (continued):

2.03 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
1. **Eaton.**
 2. **SIEMENS Industry, Inc.; Energy Management Division.**
 3. **Square D; by Schneider Electric.**
 4. **ABB Inc**
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only, as indicated.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.04 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
1. **Eaton.**
 2. **SIEMENS Industry, Inc.; Energy Management Division.**
 3. **Square D; by Schneider Electric.**
 4. **ABB Inc**
- B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers:
 - a. Inverse time-current element for low-level overloads.
 - b. Instantaneous magnetic trip element for short circuits.
 - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic Trip Circuit Breakers:
 - a. RMS sensing.
 - b. Field-replaceable rating plug or electronic trip.
 - c. Digital display of settings, trip targets, and indicated metering displays.
 - d. Multi-button keypad to access programmable functions and monitored data.
 - e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
 - f. Integral test jack for connection to portable test set or laptop computer.
 - g. Field-Adjustable Settings:
 - 1) Instantaneous trip.
 - 2) Long- and short-time pickup levels.
 - 3) Long and short time adjustments.
 - 4) Ground-fault pickup level, time delay, and I squared T response.

SECTION 262416 - PANELBOARDS (continued):

4. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
5. Subfeed Circuit Breakers: Vertically mounted.
6. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Breaker handle indicates tripped status.
 - c. UL listed for reverse connection without restrictive line or load ratings.
 - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - e. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - f. 260913"ElectricalPowerMonitoringandControl."
 - g. Shunt Trip: 24-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
 - h. Rating Plugs: Three-pole breakers with ampere ratings greater than 110 amperes shall have electronic adjustable trip units.
 - i. Multipole units enclosed in a single housing with a single handle.

2.05 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

SECTION 262416 - PANELBOARDS (continued):

3.02 INSTALLATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NEMA PB 1.1.
- D. Equipment Mounting:
 - 1. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- E. Mount panelboard cabinet plumb and rigid without distortion of box.
- F. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- G. Mount surface-mounted panelboards to steel slotted supports **5/8 inch (16 mm)** in depth. Orient steel slotted supports vertically.
- H. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
 - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.
- I. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- J. Install filler plates in unused spaces.
- K. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.03 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

SECTION 262416 - PANELBOARDS (continued):

3.04 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Standard-grade receptacles, 125 V, 20 A.
 - 2. GFCI receptacles, 125 V, 20 A.
 - 3. SPD receptacles, 125 V, 20 A.
 - 4. Toggle switches, 120/277 V, 20 A.
 - 5. Wall plates.

1.03 DEFINITIONS

- A. AFCI: Arc-fault circuit interrupter.
- B. EMI: Electromagnetic interference.
- C. GFCI: Ground-fault circuit interrupter.
- D. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.04 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Comply with NFPA 70.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Devices for Owner-Furnished Equipment:

SECTION 262726 - WIRING DEVICES (continued):

1. Receptacles: Match plug configurations.

F. Device Color:

1. Wiring Devices Connected to Normal Power System: White unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Optional Standby System: Gray.
3. SPD Devices: Blue.

- G. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

A. Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and FS W-C-596.

2.03 GFCI RECEPTACLES, 125 V, 20 A

A. Tamper-Resistant Duplex GFCI Receptacles, 125 V, 20 A:

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Type: Non-feed through.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

2.04 SPD RECEPTACLES, 125 V, 20 A

A. Duplex SPD Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral SPD in line to ground, line to neutral, and neutral to ground. LED indicator light.
2. SPD Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
3. Active SPD Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
4. Configuration: NEMA WD 6, Configuration 5-20R.
5. Standards: Comply with NEMA WD 1, UL 498, UL 1449, and FS W-C-596.

2.05 TOGGLE SWITCHES, 120/277 V, 20 A

A. Single-Pole Switches, 120/277 V, 20 A:

SECTION 262726 - WIRING DEVICES (continued):

- 1. Standards: Comply with UL 20 and FS W-S-896.
- B. Two-Pole Switches, 120/277 V, 20 A:
 - 1. Comply with UL 20 and FS W-S-896.

2.06 WALL PLATES

- A. Single Source: Obtain wall plates from same manufacturer of wiring devices.
- B. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material: Smooth, high-impact thermoplastic.
 - 3. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.
- D. 271513" CommunicationsCopperHorizontalCabling. "]
- E. Flap-TypeServiceFittings:
- F. <Doubleclickheretofind,evaluate,andinsertlistofmanufacturersandproducts.>
- G. Description:Type:Modular,flap-type,dual-serviceunitssuitableforwiringmethodused,withflapsflushwithfinishedfloor.
- H. Compartments:Barrierseparatespowerfromvoiceanddatacommunicationcabling.
- I. Flaps:[Rectangular][Round],[die-castaluminum][solidbrass]withsatinfinish.
- J. ServicePlate:Samefinishasflaps.
- K. PowerReceptacle:NEMAWD6Configuration5-20R,grayfinish,unlessotherwiseindicated.
- L. DataCommunicationOutlet:[Blankcoverwithbushedcableopening.][Twomodular,keyed,color-coded,RJ-45jacksfortwistedpaircable,complyingwithrequirementsinSection271513" CommunicationsCopper HorizontalCabling. "]
- M. Above-FloorServiceFittings:
- N. <Doubleclickheretofind,evaluate,andinsertlistofmanufacturersandproducts.>
- O. Description:Type:Modular,above-floor,dual-serviceunitssuitableforwiringmethodused.
- P. Compartments:Barrierseparatespowerfromvoiceanddatacommunicationcabling.
- Q. ServicePlate:[Rectangular][Round],[die-castaluminum][solidbrass]withsatinfinish.
- R. PowerReceptacle:NEMAWD6Configuration5-20R,grayfinish,unlessotherwiseindicated.

SECTION 262726 - WIRING DEVICES (continued):

- S. **Data Communication Outlet:** [Blank cover with bushed cable opening.] [Two modular, keyed, color-coded, RJ-45 jacks for twisted pair cable, complying with requirements in Section 271513 "Communications Copper Horizontal Cabling."]
- T. **POKE-THROUGH ASSEMBLIES** <Insert drawing designation>
- U. **Description:** Factory-fabricated and wired assembly of below-floor junction box with multi-channeled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
- V. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- W. **Standards:** Comply with scrub water exclusion requirements in UL 514.
- X. **Service-Outlet Assembly:** [Pedestal type with services indicated] [Flush type with two simplex receptacles and space for two RJ-45 jacks] [Flush type with four simplex receptacles and 6-gang space for four RJ-45 jacks low voltage systems], complying with requirements in Section 271513 "Communications Copper Horizontal Cabling."
- Y. **Size:** Selected to fit nominal [3-inch (75-mm)] [48-inch (100200-mm)] core holes in floor and matched to floor thickness.
- Z. **Fire Rating:** Unit is listed and labeled for fire rating of floor-ceiling assembly.
- AA. **Closure Plug:** Arranged to close unused [3-inch (75-mm)] [4-inch (100-mm)] core openings and reestablish fire rating of floor.
- BB. **Wiring Raceways and Compartments:** For a minimum of four No. 12 AWG conductors and a minimum of [two] [four], four-pair cable that comply with requirements in Section 271513 "Communications Copper Horizontal Cabling."
- CC. **PREFABRICATED MULTI-OUTLET ASSEMBLIES** <Insert drawing designation>

PART 3 - DE EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:

SECTION 262726 - WIRING DEVICES (continued):

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailling existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than **6 inches (152 mm)** in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.02 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

END OF SECTION 262726

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SECTION 262813 - FUSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Cartridge fuses rated 600 V ac and less for use in the following:
 - a. Control circuits.
 - b. Motor-control centers.
 - c. Panelboards.
 - d. Switchboards.
 - e. Enclosed controllers.
 - f. Enclosed switches.
 - 2. Spare-fuse cabinets.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
 - 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 2. Current-limitation curves for fuses with current-limiting characteristics.
 - 3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit in electronic format suitable for use in coordination software.
 - 4. Coordination charts and tables and related data.

1.04 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

SECTION 262813 - FUSES (continued):

1.05 FIELD CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than **40 deg F (5 deg C)** or more than **100 deg F (38 deg C)**, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Edison Fuse, Inc.
 - 3. Littelfuse, Inc.
- B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.02 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
 - 1. Type RK-1: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
 - 2. Type RK-5: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
 - 3. Type CC: 600-V, zero- to 30-A rating, 200 kAIC, fast acting.
 - 4. Type J: 600-V, zero- to 600-A rating, 200 kAIC, fast acting , time delay.
 - 5. Type L: 600-V, 601- to 6000-A rating, 200 kAIC, time delay.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

2.03 SPARE-FUSE CABINET

- A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
 - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
 - 2. Finish: Gray, baked enamel.
 - 3. Identification: "SPARE FUSES" in **1-1/2-inch- (38-mm-)** high letters on exterior of door.
 - 4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

SECTION 262813 - FUSES (continued):

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FUSE APPLICATIONS

- A. Cartridge Fuses:
 - 1. Service Entrance: Class L, time delay or Class J, time delay.
 - 2. Feeders: Class L, time delay or Class J, time delay.
 - 3. Motor Branch Circuits: Class RK1, time delay or Class J, time delay.
 - 4. Large Motor Branch (601-4000 A): Class L, time delay.
 - 5. Other Branch Circuits: Class RK1, time delay, Class J, fast acting or Class CC, fast acting.
 - 6. Control Transformer Circuits: Class CC, time delay, control transformer duty.
 - 7. Provide open-fuse indicator fuses or fuse covers with open fuse indication.

3.03 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s) in location shown on the Drawings or as indicated in the field by Owner.

3.04 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

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SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers (MCCBs).
 - 4. Enclosures.

1.03 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Division 01 "Operation and Maintenance Data," include the following:
 - a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF electronic format.

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS (continued):

1.06 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than **minus 22 deg F (minus 30 deg C)** and not exceeding **104 deg F (40 deg C)**.
 - 2. Altitude: Not exceeding **6600 feet (2010 m)**.

1.07 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

2.02 FUSIBLE SWITCHES

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1. **ABB Inc.**
 - 2. **Eaton.**
 - 3. **SIEMENS Industry, Inc.; Energy Management Division.**
 - 4. **Square D.**
- B. Type HD, Heavy Duty, Three Pole, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses and lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Three Pole, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses and lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Accessories:

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS (continued):

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 24-V ac.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.
6. Service-Rated Switches: Labeled for use as service equipment.

2.03 NONFUSIBLE SWITCHES

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
1. [Eaton.](#)
 2. [ABB Inc.](#)
 3. [SIEMENS Industry, Inc.; Energy Management Division.](#)
 4. [Square D.](#)
- B. Type HD, Heavy Duty, Three Pole, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Three Pole, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 24-V ac.
 5. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.04 MOLDED-CASE CIRCUIT BREAKERS

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
1. [Eaton.](#)
 2. [ABB Inc.](#)
 3. [SIEMENS Industry, Inc.; Energy Management Division.](#)
 4. [Square D.](#)
- B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
- C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS (continued):

escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

- D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. MCCBs shall be equipped with a device for locking in the isolated position.
- E. Lugs shall be suitable for 140 deg F (60 deg C) rated wire on 125-A circuit breakers and below.
- F. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- G. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- H. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- I. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.

2.05 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1), gray baked enamel paint, electrodeposited on cleaned, phosphatized galvanized steel (NEMA 250 Types 3R, 12) or a brush finish on Type 304 stainless steel (NEMA 250 Type 4-4X stainless steel), copper-free cast aluminum alloy (NEMA 250 Types 7, 9), as indicated.
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.
- D. Operating Mechanism: The circuit-breaker operating handle shall be directly operable through the front cover of the enclosure (NEMA 250 Type 1), directly operable through the dead front trim of the enclosure (NEMA 250 Type 3R), or externally operable with the operating mechanism being an integral part of the cover (NEMA 250 Types 7, 9). The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.
- E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.
- F. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS (continued):

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.02 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R.

3.03 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NFPA 70 and NECA 1.

3.04 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.05 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections for Switches:

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS (continued):

1. Visual and Mechanical Inspection:

- a. Inspect physical and mechanical condition.
- b. Inspect anchorage, alignment, grounding, and clearances.
- c. Verify that the unit is clean.
- d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
- e. Verify that fuse sizes and types match the Specifications and Drawings.
- f. Verify that each fuse has adequate mechanical support and contact integrity.
- g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
- h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
- i. Verify correct phase barrier installation.
- j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

C. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:

- a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
- b. Inspect physical and mechanical condition.
- c. Inspect anchorage, alignment, grounding, and clearances.
- d. Verify that the unit is clean.
- e. Operate the circuit breaker to ensure smooth operation.
- f. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
- g. Inspect operating mechanism, contacts, and chutes in unsealed units.
- h. Perform adjustments for final protective device settings in accordance with the coordination study.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS (continued):

- E. Prepare test and inspection reports.
 - 1. Test procedures used.
 - 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
 - 3. List deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262816

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SECTION 263213.13 - DIESEL-ENGINE-DRIVEN GENERATOR SETS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Diesel engine.
 - 2. Diesel fuel-oil system.
 - 3. Control and monitoring.
 - 4. Generator overcurrent and fault protection.
 - 5. Generator, exciter, and voltage regulator.
 - 6. Outdoor engine generator enclosure.
 - 7. Vibration isolation devices.

1.02 DEFINITIONS

- A. EPS: Emergency power supply.
- B. EPSS: Emergency power supply system.
- C. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 2. Include thermal damage curve for generator.
 - 3. Include time-current characteristic curves for generator protective device.
 - 4. Include fuel consumption in gallons per hour (liters per hour) at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
 - 5. Include generator efficiency at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
 - 6. Include airflow requirements for cooling and combustion air in cubic feet per minute (cubic meters per minute) at 0.8 power factor, with air-supply temperature of 95, 80, 70, and 50 deg F (35, 27, 21, and 10 deg C). Provide Drawings indicating requirements and limitations for location of air intake and exhausts.
 - 7. Include generator characteristics, including, but not limited to, kilowatt rating, efficiency, reactances, and short-circuit current capability.
- B. Shop Drawings:
 - 1. Include plans and elevations for engine generator and other components specified. Indicate access requirements affected by height of subbase fuel tank.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Identify fluid drain ports and clearance requirements for proper fluid drain.

SECTION 263213.13 - DIESEL-ENGINE-DRIVEN GENERATOR SETS (continued):

4. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for engine generators and functional relationship between all electrical components.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals.
 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
 - b. Operating instructions laminated and mounted adjacent to generator location.
 - c. Training plan.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

1.06 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Caterpillar, Inc.; Electric Power Division.
 2. Cummins Power Generation.
 3. Generac.
 4. Kohler Power Systems.
- B. Source Limitations: Obtain packaged engine generators and auxiliary components from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. B11 Compliance: Comply with B11.19.

SECTION 263213.13 - DIESEL-ENGINE-DRIVEN GENERATOR SETS (continued):

- B. NFPA Compliance:
 - 1. Comply with NFPA 37.
 - 2. Comply with NFPA 70.
 - 3. Comply with NFPA 99.
 - 4. Comply with NFPA 110 requirements for Level 1 EPSS.
- C. UL Compliance: Comply with UL 2200.
- D. Engine Exhaust Emissions: Comply with EPA Tier 3 requirements and applicable state and local government requirements.
- E. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by engine generator including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.
- F. Environmental Conditions: Engine generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - 1. Ambient Temperature: 41 to 104 deg F (5 to 40 deg C).
 - 2. Altitude: Sea level to 1000 feet (300 m).
- G. Unusual Service Conditions: Engine generator equipment and installation are required to operate under the following conditions:
 - 1. High salt-dust content in the air due to sea-spray evaporation.

2.03 ENGINE GENERATOR ASSEMBLY DESCRIPTION

- A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- C. Power Rating: Standby.
- D. Induction Method: Naturally aspirated.
- E. Governor: Adjustable isochronous, with speed sensing.
- F. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.
 - 1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and engine generator center of gravity.
- G. Capacities and Characteristics:
 - 1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries, with capacity as required to operate as a unit as evidenced by records of prototype testing.
 - 2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

SECTION 263213.13 - DIESEL-ENGINE-DRIVEN GENERATOR SETS (continued):

H. Engine Generator Performance for Sensitive Loads:

1. Oversizing generator compared with the rated power output of the engine is permissible to meet specified performance.
 - a. Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.
2. Steady-State Voltage Operational Bandwidth: 1 percent of rated output voltage from no load to full load.
3. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 0.5 second.
4. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
5. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
6. Transient Frequency Performance: Less than 2-Hz variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within three seconds.
7. Output Waveform: At no load, harmonic content measured line to neutral shall not exceed 2 percent total with no slot ripple. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
8. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components.
9. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.
 - a. Provide permanent magnet excitation for power source to voltage regulator.
10. Start Time:
 - a. Comply with NFPA 110, Type 10 system requirements.

2.04 DIESEL ENGINE

- A. Fuel: ASTM D975, diesel fuel oil, Grade 2-D S15.
- B. Rated Engine Speed: 1800 rpm.
- C. Lubrication System: Engine or skid-mounted.
 1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
 2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
 3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- D. Jacket Coolant Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with UL 499 and with NFPA 110 requirements for Level 1 equipment for heater capacity.

SECTION 263213.13 - DIESEL-ENGINE-DRIVEN GENERATOR SETS (continued):

- E. Integral Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator set mounting frame and integral engine-driven coolant pump.
1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
 2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
 3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
 4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
 5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, UV-, and abrasion-resistant fabric.
 - a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
 - b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
- F. Muffler/Silencer:
1. Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
 - a. Minimum sound attenuation of 25 dB at 500 Hz.
 - b. Sound level measured at a distance of 25 feet (8 m) from exhaust discharge after installation is complete shall be 78 dBA or less.
- G. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
- H. Starting System: 24-V electric, with negative ground.
1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
 3. Cranking Cycle: As required by NFPA 110 for system level specified.
 4. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least three times without recharging.
 5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
 6. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
 7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
 8. Battery Charger: Current-limiting, automatic-equalizing, and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:
 - a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.

SECTION 263213.13 - DIESEL-ENGINE-DRIVEN GENERATOR SETS (continued):

- b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from **minus 40 to 140 deg F** (**minus 40 to plus 60 deg C**) to prevent overcharging at high temperatures and undercharging at low temperatures.
- c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
- d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
- e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
- f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.05 DIESEL FUEL-OIL SYSTEM

- A. Comply with NFPA 37.
- B. Piping: Fuel-oil piping shall be Schedule 40 black steel, complying with requirements in Section 231113 "Facility Fuel-Oil Piping." Cast iron, aluminum, copper, and galvanized steel shall not be used in the fuel-oil system.
- C. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions.
- D. Fuel Filtering: Remove water and contaminants larger than 1 micron.
- E. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
- F. 231323"FacilityAbovegroundFuel-OilStorageTanks."]
- G. FuelTankCapacity:[Minimum133percentoftotalfuelrequiredforperiodicmaintenanceoperationsbetweenfuelrefillsplusfuelforthehoursofcontinuousoperationrequiredfortheindicatedEPSSClass.][Asrecommendedbyenginemanufacturerforanuninterruptedperiodof8hours'operationat100percentofratedpoweroutputofenginegeneratorsystemwithoutbeingrefilled]<Insertgallons(liters)>.
- H. DuplexFuel-OilTransferPump:ComplywithrequirementsinSection231213"FacilityFuel-OilPumps."
- I. DayTank:ComplywithUL142,freestanding,factory-fabricatedfuel tankassembly,withintegral,float-controlledtransferpumpandthefollowingfeatures:
- J. Containment:Integralrupturebasinwithacapacityof150percentofnominalcapacityofdaytank.
- K. LeakDetector:Locateinrupturebasinandconnecttoprovideaudibleandvisualalarmintheeventofday-tankleak.
- L. TankCapacity:[Asrecommendedbyenginemanufacturerforanuninterruptedperiodof4hours'operationat100percentofratedpoweroutputofenginegeneratorsystemwithoutbeingrefilled]<Insertgallons(liters)>.
- M. PumpCapacity:Exceedsmaximumflowoffueldrawnbyengine-mountedfuelsupplypumpat110percentofratedcapacity,includingfuelreturnedfromengine.
- N. Low-LevelAlarmSensor:Liquid-leveldeviceoperatesalarmcontactsat25percentofnormalfuellevel.
- O. High-LevelAlarmSensor:Liquid-leveldeviceoperatesalarmandredundantfuelshutoffcontactsatmidpointbetweenoverflowleveland100percentofnormalfuellevel.

SECTION 263213.13 - DIESEL-ENGINE-DRIVEN GENERATOR SETS (continued):

- P. PipingConnections:Factory-installedfuelsupplyandreturnlinesfromtanktoengine;localfuelfill,ventline,overflowline;andtankdrainlinewithshutoffvalve.
- Q. RedundantHigh-LevelFuelShutoff:Actuatedbyhigh-levelalarmsensorindaytanktooperateaseparate motor-controldevice that disconnects day-tank pump motor. Sensor shall signal solenoid valve, located in fuel suction line between fuel storage tank and day tank, to close. Both actions shall remain in shutoff state until manually reset. Shutoff actions shall initiate an alarm signal to control panel but shall not shut down engine generator.
- R. Subbase-Mounted, Double-Wall, Fuel-Oil Tank: Factory installed and piped, complying with UL 142 fuel-oil tank. Features include the following:
 - 1. Tank level indicator.
 - 2. Fuel-Tank Capacity: Minimum 133 percent of total fuel required for planned operation plus fuel for periodic maintenance operations between fuel refills.
 - 3. Leak detection in interstitial space.
 - 4. Vandal-resistant fill cap.
 - 5. Containment Provisions: Comply with requirements of authorities having jurisdiction.

2.06 CONTROL AND MONITORING

- A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.
- B. Provide minimum run time control set for 15 minutes with override only by operation of a remote emergency-stop switch.
- C. Comply with UL 508A.
- D. Configuration:
 - 1. Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from engine generator vibration. Panel shall be powered from the engine generator battery.
 - 2. Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common wall-mounted control and monitoring panel. Panel shall be powered from the engine generator battery.
- E. Control and Monitoring Panel:
 - 1. Digital engine generator controller with integrated LCD display, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
 - 2. Instruments: Located on the control and monitoring panel and viewable during operation.
 - a. Engine lubricating-oil pressure gage.
 - b. Engine-coolant temperature gage.
 - c. DC voltmeter (alternator battery charging).
 - d. Running-time meter.

SECTION 263213.13 - DIESEL-ENGINE-DRIVEN GENERATOR SETS (continued):

- e. AC voltmeter, for each phase.
 - f. AC ammeter, for each phase.
 - g. AC frequency meter.
 - h. Generator-voltage adjusting rheostat.
3. Controls and Protective Devices: Controls, shutdown devices, and common alarm indication, including the following:
- a. Cranking control equipment.
 - b. Run-Off-Auto switch.
 - c. Control switch not in automatic position alarm.
 - d. Overcrank alarm.
 - e. Overcrank shutdown device.
 - f. Low-water temperature alarm.
 - g. High engine temperature prealarm.
 - h. High engine temperature.
 - i. High engine temperature shutdown device.
 - j. Overspeed alarm.
 - k. Overspeed shutdown device.
 - l. Low fuel main tank.
- 1) Low-fuel-level alarm shall be initiated when the level falls below that required for operation for duration required for the indicated EPSS class.
- m. Coolant low-level alarm.
 - n. Coolant low-level shutdown device.
 - o. Coolant high-temperature prealarm.
 - p. Coolant high-temperature alarm.
 - q. Coolant low-temperature alarm.
 - r. Coolant high-temperature shutdown device.
 - s. EPS load indicator.
 - t. Battery high-voltage alarm.
 - u. Low cranking voltage alarm.
 - v. Battery-charger malfunction alarm.
 - w. Battery low-voltage alarm.
 - x. Lamp test.
 - y. Contacts for local and remote common alarm.
 - z. Remote manual stop shutdown device.
 - aa. Air shutdown damper alarm when used.
 - bb. Air shutdown damper shutdown device when used.
 - cc. Generator overcurrent-protective-device not-closed alarm.
 - dd. Hours of operation.
 - ee. Engine generator metering, including voltage, current, hertz, kilowatt, kilovolt ampere, and power factor.
- F. 260913 "Electrical Power Monitoring and Control." [Section 262713 "Electricity Metering." [Section 260913 "Electrical Power Monitoring and Control" and Section 262713 "Electricity Metering."]]**
- G. Connection to Datalink:**
- 1. A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication.
 - 2. Provide connections for datalink transmission of indications to remote data terminals via ModBus. Data system connections to terminals are covered in Section 260913 "Electrical Power Monitoring and Control."

SECTION 263213.13 - DIESEL-ENGINE-DRIVEN GENERATOR SETS (continued):

- H. Remote Alarm Annunciator: An LED indicator light labeled with proper alarm conditions shall identify each alarm event, and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.
 - 1. Overcrank alarm.
 - 2. Low water-temperature alarm.
 - 3. High engine temperature prealarm.
 - 4. High engine temperature alarm.
 - 5. Low lube oil pressure alarm.
 - 6. Overspeed alarm.
 - 7. Low fuel main tank alarm.
 - 8. Low coolant level alarm.
 - 9. Low cranking voltage alarm.
 - 10. Contacts for local and remote common alarm.
 - 11. Audible-alarm silencing switch.
 - 12. Air shutdown damper when used.
 - 13. Run-Off-Auto switch.
 - 14. Control switch not in automatic position alarm.
 - 15. Low-cranking voltage alarm.
- I. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator unless otherwise indicated.
- J. Remote Emergency-Stop Switch: Flush; wall mounted unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

2.07 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Overcurrent protective devices shall be coordinated to optimize selective tripping when a short circuit occurs.
 - 1. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.
- B. Generator Overcurrent Protective Device:
 - 1. Molded-case circuit breaker, electronic-trip type; 100 percent rated; complying with UL 489:
 - a. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
 - b. Trip Settings: Selected to coordinate with generator thermal damage curve.
 - c. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
 - d. Mounting: Adjacent to, or integrated with, control and monitoring panel.
- C. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground fault.
 - 1. Indicate ground fault with other engine generator alarm indications.

2.08 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.

SECTION 263213.13 - DIESEL-ENGINE-DRIVEN GENERATOR SETS (continued):

- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required. Provide 12-lead alternator.
- E. Range: Provide broad range of output voltage by adjusting the excitation level.
- F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- G. Enclosure: Dripproof.
- H. Instrument Transformers: Mounted within generator enclosure.
- I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified and as required by NFPA 110.
 - 1. Adjusting Rheostat on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
 - 2. Maintain voltage within 15 percent on one step, full load.
 - 3. Provide anti-hunt provision to stabilize voltage.
 - 4. Maintain frequency within 10 percent and stabilize at rated frequency within 2 seconds.
- J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
- K. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- L. Subtransient Reactance: 12 percent, maximum.

2.09 OUTDOOR ENGINE GENERATOR ENCLOSURE

- A. Description:
 - 1. Vandal-resistant, sound-attenuating, weatherproof steel housing; wind resistant up to 200 mph (320 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.
 - a. Sound Attenuation Level: Level 2.
- B. Structural Design and Anchorage: Comply with ASCE/SEI 7 for wind loads up to 200 mph (320 km/h).
- C. Hinged Doors: With padlocking provisions.
- D. Space Heater: Thermostatically controlled and sized to prevent condensation.
- E. Lighting: Provide weather-resistant LED lighting with 30 fc (330 lx) average maintained.
- F. Muffler Location: Within enclosure.

SECTION 263213.13 - DIESEL-ENGINE-DRIVEN GENERATOR SETS (continued):

- G. Engine-Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for two hours with ambient temperature at top of range specified in system service conditions.
 - 1. Louvers: Fixed-engine, cooling-air inlet and discharge. AMCA 540 for missile impact, stormproof and drainable louvers prevent entry of rain and snow.
- H. Interior Lights with Switch: Factory-wired, vapor-proof luminaires within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.
 - 1. AC lighting system and connection point for operation when remote source is available.
 - 2. DC lighting system for operation when remote source and generator are both unavailable.
- I. Convenience Outlets: Factory-wired, GFCI. Arrange for external electrical connection.

2.10 VIBRATION ISOLATION DEVICES

- A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
 - 1. Material: Standard neoprene separated by steel shims.
 - 2. Minimum Deflection: 1 inch (25 mm).
- B. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

2.11 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.12 SOURCE QUALITY CONTROL

- A. Project-Specific Equipment Tests: Before shipment, factory test engine generator and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
 - 1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
 - 2. Test generator, exciter, and voltage regulator as a unit.
 - 3. Full load run.
 - 4. Maximum power.
 - 5. Voltage regulation.
 - 6. Transient and steady-state governing.
 - 7. Single-step load pickup.
 - 8. Safety shutdown.
 - 9. Report factory test results within 10 days of completion of test.

SECTION 263213.13 - DIESEL-ENGINE-DRIVEN GENERATOR SETS (continued):

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.
- B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Comply with NECA 1 and NECA 404.
- B. Comply with packaged engine generator manufacturers' written installation and alignment instructions and with NFPA 110.
- C. Equipment Mounting:
 - 1. Install packaged engine generators on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
 - 2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- D. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- E. 232113 "Hydronic Piping."
- F. Install flexible connectors and steel piping materials according to requirements in Section 232116 "Hydronic Piping Specialties."
- G. Install muffler/silencer and exhaust system components according to requirements in Section 230719 "HVAC Piping Insulation."
- H. Install isolating thimbles where exhaust piping penetrates combustible surfaces with a minimum of 9 inches (225 mm) of clearance from combustibles.
- I. Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.03 CONNECTIONS

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90-degree bend in flexible conduit routed to the engine generator from a stationary element.

SECTION 263213.13 - DIESEL-ENGINE-DRIVEN GENERATOR SETS (continued):

- C. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

3.04 IDENTIFICATION

- A. Identify system components according to Section 230553 "Identification for HVAC Piping and Equipment" and Section 260553 "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service::

- 1. Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

- B. Tests and Inspections:

- 1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in first two subparagraphs below, as specified in NETA ATS. Certify compliance with test parameters.

- a. Visual and Mechanical Inspection:

- 1) Compare equipment nameplate data with Drawings and the Specifications.
 - 2) Inspect physical and mechanical condition.
 - 3) Inspect anchorage, alignment, and grounding.
 - 4) Verify that the unit is clean.

- b. Electrical and Mechanical Tests:

- 1) Perform insulation-resistance tests according to IEEE 43.
 - a) Machines Larger Than 200 hp (150 kW): Test duration shall be 10 minutes. Calculate polarization index.
 - b) Machines 200 hp (150 kW) or Less: Test duration shall be one minute. Calculate the dielectric-absorption ratio.
 - 2) Test protective relay devices.
 - 3) Verify phase rotation, phasing, and synchronized operation as required by the application.
 - 4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
 - 5) Perform vibration test for each main bearing cap.
 - 6) Verify correct functioning of the governor and regulator.

- 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.

- 3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

- a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.

SECTION 263213.13 - DIESEL-ENGINE-DRIVEN GENERATOR SETS (continued):

- c. Verify acceptance of charge for each element of the battery after discharge.
 - d. Verify that measurements are within manufacturer's specifications.
 - 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
 - 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
 - 6. Noise Level Tests: Measure A-weighted level of noise emanating from engine generator installation, including engine exhaust and cooling-air intake and discharge, at four locations **25 feet (8 m)** from edge of the generator enclosure, and compare measured levels with required values.
- C. Coordinate tests with tests for transfer switches and run them concurrently.
- D. Test instruments shall have been calibrated within the past 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.
- E. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.
- F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.
- G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- H. Remove and replace malfunctioning units and retest as specified above.
- I. Retest: Correct deficiencies identified by tests and observations, and retest until specified requirements are met.
- J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.06 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's authorized service representative. Include quarterly preventive maintenance and exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Parts shall be manufacturer's authorized replacement parts and supplies.

3.07 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 263213.13

SECTION 263353 - STATIC UNINTERRUPTIBLE POWER SUPPLY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. UPS systems.
 - 2. Surge suppression.
 - 3. Rectifier-charger.
 - 4. Inverter.
 - 5. Controls and indications.
 - 6. Static bypass transfer switch.
 - 7. Maintenance bypass/isolation switch.
 - 8. Output isolation transformer.
 - 9. Remote status and alarm panel.
 - 10. Remote monitoring.
 - 11. Battery.
 - 12. Basic battery monitoring.
 - 13. Battery-cycle warranty monitoring.

1.03 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GTO: Gate turn-off thyristor.
- C. IGBT: Isolated gate bipolar transistor.
- D. LCD: Liquid-crystal display.
- E. LED: Light-emitting diode.
- F. NiCd: Nickel cadmium.
- G. PC: Personal computer.
- H. SPD: Surge protection device.
- I. THD: Total harmonic distortion.
- J. UPS: Uninterruptible power supply.

SECTION 263353 - STATIC UNINTERRUPTIBLE POWER SUPPLY (continued):

1.04 ACTION SUBMITTALS

A. Product Data: For each type of UPS.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for UPS.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For UPS units to include in emergency, operation, and maintenance manuals.

1.06 WARRANTY

A. Special Battery Warranties: Manufacturer and Installer agree to repair or replace UPS system storage batteries that fail in materials or workmanship within specified warranty period.

1. Warranted Cycle Life for Valve-Regulated, Lead-Calcium Batteries: Equal to or greater than that represented in manufacturer's published table, but not less than the following, based on annual average battery temperature of 77 deg F (25 deg C):

Discharge Rate	Discharge Duration	Discharge End Voltage	Cycle Life
8 hours	8 hours	1.67	40 cycles
30 minutes	30 minutes	1.67	125 cycles
15 minutes	1.5 minutes	1.67	750 cycles

B. Special UPS Warranties: Specified form in which manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within special warranty period.

1. Special Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 OPERATIONAL REQUIREMENTS

A. Automatic operation includes the following:

1. Double Conversion, IGBT:
 - a. Normal Conditions: Load is supplied with power flowing from the normal power input terminals, through the rectifier-charger and inverter, with the battery connected in parallel with the rectifier-charger output. High-efficiency carrier stored trench IGBT, in both rectifier-charger and inverter circuits, provides a minimum of 97 percent efficiency for the UPS system at full load and a minimum of 94 percent efficiency at 50 percent load.

SECTION 263353 - STATIC UNINTERRUPTIBLE POWER SUPPLY (continued):

- b. Abnormal Supply Conditions: If normal supply deviates from specified and adjustable voltage, voltage waveform, or frequency limits, the battery supplies energy to provide constant, regulated inverter power output to the load.
 - c. Power Failure: If normal power fails, the rectifier-charger and inverter use energy from the battery to supply constant, regulated power output to the load without switching or disturbance.
 - 2. When power is restored at the normal supply terminals of the system, controls shall automatically synchronize the inverter with the external source before transferring the load. The rectifier-charger shall supply power to the load through the inverter and simultaneously recharge the battery.
 - 3. If the battery becomes discharged and normal supply is available, the rectifier-charger shall charge the battery. The rectifier-charger shall automatically shift to float-charge mode on reaching full charge.
 - 4. If any element of the UPS system fails and power is available at the normal supply terminals of the system, the static bypass transfer switch shall switch the load to the normal ac supply circuit without disturbance or interruption.
 - 5. The output power converters shall produce up to 300 percent of rated full-load current for short-circuit clearing. The inverter shall sustain steady-state overload conditions of up to 200 percent of rated full-load current for 60 seconds in normal operation.
 - 6. The inverter shall be capable of sustaining 150 percent of system capacity for 30 seconds while powered from the battery.
 - 7. Should overloads persist past the time limitations, the automatic static transfer switch shall switch the load to the bypass output of the UPS. When the fault has cleared, the static bypass transfer switch shall return the load to the UPS system.
 - 8. If the battery is disconnected, the UPS shall supply power to the load from the normal supply with no degradation of its regulation of voltage and frequency of the output bus.
- B. Manual operation includes the following:
- 1. Turning the inverter off causes the static bypass transfer switch to transfer the load directly to the normal ac supply circuit without disturbance or interruption.
 - 2. Turning the inverter on causes the static bypass transfer switch to transfer the load to the inverter.
- C. Maintenance Bypass/Isolation Switch Operation: Switch is interlocked so it cannot be operated unless the static bypass transfer switch is in the bypass mode. Device provides manual selection among the three conditions described below without interrupting supply to the load during switching:
- 1. Full Isolation: Load is supplied, bypassing the UPS. Normal UPS ac input circuit, static bypass transfer switch, and UPS load terminals are completely disconnected from external circuits.
 - 2. Maintenance Bypass: Load is supplied, bypassing the UPS. UPS ac supply terminals are energized to permit operational checking, but system load terminals are isolated from the load.
 - 3. Normal: Normal UPS ac supply terminals are energized and the load is supplied through the static bypass transfer switch and the UPS rectifier-charger and inverter, or the battery and the inverter.
- D. Environmental Conditions: The UPS shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability, except battery performance:
- 1. Ambient Temperature for Electronic Components: 32 to 104 deg F (0 to 40 deg C).
 - 2. Ambient Temperature for Battery: 41 to 95 deg F (5 to 35 deg C).
 - 3. Relative Humidity: Zero to 95 percent, noncondensing.
 - 4. Altitude: Sea level to 4000 feet (1220 m).

SECTION 263353 - STATIC UNINTERRUPTIBLE POWER SUPPLY (continued):

2.02 PERFORMANCE REQUIREMENTS

- A. UL Compliance: Listed and labeled by an NRTL to comply with UL 1778.
- B. NFPA Compliance: UPS components shall be listed and labeled by an NRTL as suitable for installation in computer rooms according to NFPA 75.
- C. The UPS shall perform as specified in this article while supplying rated full-load current, composed of any combination of linear and nonlinear load, up to 100 percent nonlinear load with a maximum load crest factor of 3.0, under the following conditions or combinations of the following conditions:
 - 1. Inverter is switched to battery source.
 - 2. Steady-state ac input voltage deviates up to plus or minus 15 percent from nominal voltage.
 - 3. Steady-state input frequency deviates up to plus or minus 5 percent from nominal frequency.
 - 4. THD of input voltage is 15 percent or more with a minimum crest factor of 3.0, and the largest single harmonic component is a minimum of 5 percent of the fundamental value.
 - 5. Load is 50 percent unbalanced continuously.
- D. Minimum Duration of Supply: If battery is sole energy source supplying rated full-load UPS current at 80 percent power factor, duration of supply is 10 minutes.
- E. Input Voltage Tolerance: System steady-state and transient output performance remains within specified tolerances when steady-state ac input voltage varies plus 10 percent and minus 15 percent from nominal voltage.
- F. Overall UPS Efficiency: Equal to or greater than 98 percent at 100 percent load, 95 percent at 75 percent load, and 93 percent at 25 percent load.
- G. Maximum Acoustical Noise: 67 dBA, "A" weighting, emanating from any UPS component under any condition of normal operation, measured 39-inches from nearest surface of component enclosure.
- H. Maximum Energizing Inrush Current: Soft start linear input current rise to 100 percent over a 1- to 40-second period, factory set at 10 seconds.
- I. AC Output-Voltage Regulation for Loads 100 Percent Unbalanced: Maximum of plus or minus 2 percent over the full range of battery voltage.
- J. AC Output-Voltage Regulation for Loads 100 Percent Balanced: Maximum of plus or minus 1 percent over the full range of battery voltage.
- K. Output Frequency: 60 Hz, plus or minus 0.1 percent over the full range of input voltage, load, and battery voltage.
- L. Limitation of harmonic distortion of input current to the UPS shall be as follows:
 - 1. Description:
 - a. Rectifier-charger circuits shall limit THD to 5 percent, maximum, at rated full-load UPS current, for power sources with X/R ratio between 2 and 30. Provide tuned harmonic filter if required to meet harmonic distortion limit.
 - b. THD is limited to a maximum of 32 percent, at rated full-load UPS current, for power sources with X/R ratio between 2 and 30.
- M. Maximum Harmonic Content of Output-Voltage Waveform: 5 percent rms total and 3 percent rms for any single harmonic, for 100 percent rated nonlinear load current, with a load crest factor of 3.0.

SECTION 263353 - STATIC UNINTERRUPTIBLE POWER SUPPLY (continued):

- N. Minimum Overload Capacity of UPS at Rated Voltage: 125 percent of rated full load for 10 minutes, 200 percent for 60 seconds in normal operation, and 150 percent for 30 seconds in battery operating mode.
- O. Maximum Output-Voltage Transient Excursions from Rated Value: For the following instantaneous load changes, stated as percentages of rated full UPS load, voltage shall remain within stated percentages of rated value and recover to, and remain within, plus or minus 2 percent of that value within 50 ms:
 - 1. 50 Percent: Plus or minus 3 percent.
 - 2. 100 Percent: Plus or minus 5 percent.
 - 3. Loss of AC Input Power: Plus or minus 1 percent.
 - 4. Restoration of AC Input Power: Plus or minus 1 percent.
- P. Input Power Factor: A minimum of 0.95 lagging when supply voltage and current are at nominal rated values and the UPS is supplying rated full-load current without additional filters.
- Q. Output Power Factor Rating: Loads with power factor of 0.9 leading to 0.8 lagging shall not require derating of the UPS. For loads with power factors outside this range, derate the UPS output as follows:
 - 1. Derate the UPS a maximum of 5 percent for 0.7 PF lagging.
 - 2. Derate the UPS a maximum of 10 percent for 0.6 PF lagging.
 - 3. Derate the UPS a maximum of 15 percent for 0.5 PF lagging.
 - 4. Derate the UPS a maximum of 20 percent for a range of 0.4 to 0.1 PF lagging.
- R. EMI Emissions: Comply with FCC rules and regulations and with 47 CFR 15 for Class A equipment.

2.03 UPS SYSTEMS

- A. Description: Self-contained, battery backup device and accessories that provides three-phase electrical power in the event of failure or sag in the normal power system.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Corporation; Powerware Division.
 - 2. Liebert Corporation; a division of Emerson.
 - 3. Schneider Electric; APC.
- C. Electronic Equipment: Solid-state devices using hermetically sealed, semiconductor elements. Devices include rectifier-charger, inverter, static bypass transfer switch, and system controls.
- D. Enclosures: Comply with NEMA 250, Type 1, unless otherwise indicated.
- E. Configuration: Single-cabinet modular style units.
- F. Control Assemblies: Mount on modular plug-ins, readily accessible for maintenance.
- G. Maintainability Features: Mount rectifier-charger and inverter sections and the static bypass transfer switch on modular plug-ins, readily accessible for maintenance.
- H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- I. Capacity Upgrade Capability: Arrange wiring, controls, and modular component plug-in provisions to permit future 25 percent increase in UPS capacity.

SECTION 263353 - STATIC UNINTERRUPTIBLE POWER SUPPLY (continued):

- J. UPS Cabinet Ventilation: Redundant fans or blowers draw in ambient air near the bottom of cabinet and discharge it near the top rear.
- K. Output Circuit Neutral Bus, Conductor, and Terminal Ampacity: Rated phase current times a multiple of 1.73, minimum.

2.04 SURGE SUPPRESSION

- A. Protect internal UPS components from surges that enter at each ac power input connection including main disconnect switch, static bypass transfer switch, and maintenance bypass/isolation switch. Protect rectifier-charger, inverter, controls, and output components.
 - 1. Use factory-installed surge suppressors tested according to IEEE C62.41.1 and IEEE C62.41.2, Category B.
 - 2. Additional Surge Protection: Protect internal UPS components from low-frequency, high-energy voltage surges described in IEEE C62.41.1 and IEEE C62.41.2. Design the circuits connecting with external power sources and select circuit elements, conductors, conventional surge suppressors, and rectifier components and controls so input assemblies will have adequate mechanical strength and thermal and current-carrying capacity to withstand stresses imposed by 400-Hz, 180 percent voltage surges described in IEEE C62.41.1 and IEEE C62.41.2.

2.05 RECTIFIER-CHARGER

- A. Description: Voltage source converter, -pulse IGBT rectifier.
- B. Capacity: Adequate to supply the inverter during rated full output load conditions and simultaneously recharge the battery from fully discharged condition to 95 percent of full charge within 10 times the rated discharge time for duration of supply under battery power at full load.
- C. Output Ripple: Limited by output filtration to less than 0.5 percent of rated current, peak to peak.
- D. Control Circuits: Immune to frequency variations within rated frequency ranges of normal and emergency power sources.
 - 1. Response Time: Field adjustable for maximum compatibility with local generator-set power source.
- E. Battery Float-Charging Conditions: Comply with battery manufacturer's written instructions for battery terminal voltage and charging current required for maximum battery life. The battery charger shall be matched to the battery type supplied.
- F. NiCd Battery Charger: Sense full charge by measuring the rate of temperature increase. Battery charging shall be terminated when the rate of temperature rise reaches 1.8 deg F (1 deg C) per minute. If the battery reaches 140 deg F (60 deg C) prior to reaching this rate of temperature rise, charging shall terminate. Chargers that determine full charge by voltage measurement to sense a 10-mV drop per cell when reaching full charge are also acceptable.

2.06 INVERTER

- A. Description:
 - 1. Pulse-width modulated, IGBT with sinusoidal output.

SECTION 263353 - STATIC UNINTERRUPTIBLE POWER SUPPLY (continued):

2. Include a bypass phase synchronization window adjustment to optimize compatibility with local engine-generator-set power source.

2.07 CONTROLS AND INDICATIONS

- A. Description: Group displays, indications, and basic system controls on a common control panel on front of UPS enclosure.
- B. Minimum displays, indicating devices, and controls include those in lists below. Provide sensors, transducers, terminals, relays, and wiring required to support listed items. Alarms include audible signals and visual displays.
- C. Indications: Plain-language messages on a digital LCD.
 1. Quantitative indications shall include the following:
 - a. Input voltage, each phase, line to line.
 - b. Input current, each phase, line to line.
 - c. Bypass input voltage, each phase, line to line.
 - d. Bypass input frequency.
 - e. System output voltage, each phase, line to line.
 - f. System output current, each phase.
 - g. System output frequency.
 - h. DC bus voltage.
 - i. Battery current and direction (charge/discharge).
 - j. Elapsed time discharging battery.
 2. Basic status condition indications shall include the following:
 - a. Normal operation.
 - b. Load-on bypass.
 - c. Load-on battery.
 - d. Inverter off.
 - e. Alarm condition.
 3. Alarm indications shall include the following:
 - a. Bypass ac input overvoltage or undervoltage.
 - b. Bypass ac input overfrequency or underfrequency.
 - c. Bypass ac input and inverter out of synchronization.
 - d. Bypass ac input wrong-phase rotation.
 - e. Bypass ac input single-phase condition.
 - f. Bypass ac input filter fuse blown.
 - g. Internal frequency standard in use.
 - h. Battery system alarm.
 - i. Control power failure.
 - j. Fan failure.
 - k. UPS overload.
 - l. Battery-charging control faulty.
 - m. Input overvoltage or undervoltage.
 - n. Input transformer overtemperature.
 - o. Input circuit breaker tripped.
 - p. Input wrong-phase rotation.
 - q. Input single-phase condition.

SECTION 263353 - STATIC UNINTERRUPTIBLE POWER SUPPLY (continued):

- r. Approaching end of battery operation.
 - s. Battery undervoltage shutdown.
 - t. Maximum battery voltage.
 - u. Inverter fuse blown.
 - v. Inverter transformer overtemperature.
 - w. Inverter overtemperature.
 - x. Static bypass transfer switch overtemperature.
 - y. Inverter power supply fault.
 - z. Inverter transistors out of saturation.
 - aa. Identification of faulty inverter section/leg.
 - bb. Inverter output overvoltage or undervoltage.
 - cc. UPS overload shutdown.
 - dd. Inverter current sensor fault.
 - ee. Inverter output contactor open.
 - ff. Inverter current limit.
- 4. Controls shall include the following:
 - a. Inverter on-off.
 - b. UPS start.
 - c. Battery test.
 - d. Alarm silence/reset.
 - e. Output-voltage adjustment.
- D. Dry-form "C" contacts shall be available for remote indication of the following conditions:
 - 1. UPS on battery.
 - 2. UPS on-line.
 - 3. UPS load-on bypass.
 - 4. UPS in alarm condition.
 - 5. UPS off (maintenance bypass closed).
- E. Emergency Power off Switch: Capable of local operation and operation by means of activation by external dry contacts.

2.08 STATIC BYPASS TRANSFER SWITCH

- A. Description: Solid-state switching device providing uninterrupted transfer with a contactor or electrically operated circuit breaker to automatically provide electrical isolation for the switch.
- B. Switch Rating: Continuous duty at the rated full-load UPS current, minimum.
- C. Input SPD: 160 kA.

2.09 MAINTENANCE BYPASS/ISOLATION SWITCH

- A. Description: Manually operated switch or arrangement of switching devices with mechanically actuated contact mechanism arranged to route the flow of power to the load around the rectifier-charger, inverter, and static bypass transfer switch.
 - 1. Switch shall be electrically and mechanically interlocked to prevent interrupting power to the load when switching to bypass mode.
 - 2. Switch shall electrically isolate other UPS components to permit safe servicing.

SECTION 263353 - STATIC UNINTERRUPTIBLE POWER SUPPLY (continued):

3. Switch shall electrically isolate the rectifier-charger, inverter, and static bypass transfer switch from the load, but shall allow primary power to the UPS for testing.
- B. Comply with NEMA PB 2 and UL 891.
- C. Switch Rating: Continuous duty at rated full-load UPS current.
- D. Mounting Provisions: Separate wall- or floor-mounted unit.
- E. Key interlock with key that is released only when the rectifier-charger and inverter are bypassed by the static bypass transfer switch. Key shall be required to unlock maintenance bypass/isolation switch before switching from open (normal) position to closed position. Lock shall be designed specifically for mechanical and electrical component interlocking.

2.10 OUTPUT ISOLATION TRANSFORMER

- A. Description: Unit with low forward transfer impedance up to 3 kHz, minimum. Include the following features:
 1. Comply with applicable portions of UL 1561, including requirements for nonlinear load current-handling capability for a K-factor of approximately 4.
 2. Output Impedance at Fundamental Frequency: Between 3 and 4 percent.
 3. Regulation: 5 percent, maximum, at rated nonlinear load current.
 4. Full-Load Efficiency at Rated Nonlinear Load Current: 96 percent, minimum.
 5. Electrostatic Shielding of Windings: Independent for each winding.
 6. Coil Leads: Physically arranged for minimum interlead capacitance.
 7. Shield Grounding Terminal: Separately mounted; labeled "Shield Ground."
 8. Capacitive Coupling between Primary and Secondary: 33 pF, maximum, over a frequency range of 20 Hz to 1 MHz.

2.11 REMOTE STATUS AND ALARM PANEL

- A. Description: Labeled LEDs on panel faceplate indicating five basic status conditions. Audible signal indicates alarm conditions. Silencing switch in face of panel silences signal without altering visual indication.
 1. Cabinet and Faceplate: Surface or flush mounted to suit mounting conditions indicated.

2.12 REMOTE MONITORING

- A. Description: Communication module in unit control panel provides capability for remote monitoring of status, parameters, and alarms specified in "Controls and Indications" Article. The remote computer and the connecting signal wiring are not included in this Section. Include the following features:
 1. Connectors and network interface units for data transmission via RS-485, Ethernet, or web-based link.
 2. Software designed for control and monitoring of UPS functions and to provide on-screen explanations, interpretations, diagnosis, action guidance, and instructions for use of monitoring indications and development of meaningful reports. Permit storage and analysis of power-line transient records. Designs for Windows applications, software, and computer are not included in this Section.

SECTION 263353 - STATIC UNINTERRUPTIBLE POWER SUPPLY (continued):

3. Software and Hardware: Compatible with that specified in Section 260913 "Electrical Power Monitoring and Control."

2.13 BATTERY

A. Description:

1. Valve-regulated, recombinant, lead-calcium units, factory assembled in an isolated compartment of UPS cabinet, complete with battery disconnect switch.
 - a. Arrange for drawout removal of battery assembly from cabinet for testing and inspecting.

2.14 BASIC BATTERY MONITORING

- A. Description: Continuous, real-time capture of battery performance data.
- B. Battery Ground-Fault Detector: Initiates alarm when resistance to ground of positive or negative bus of battery is less than 5000 ohms.
- C. Battery compartment smoke/high-temperature detector initiates an alarm when smoke or a temperature greater than 167 deg F (75 deg C) occurs within the compartment.
- D. Annunciation of Alarms: At UPS control panel and remotely.

2.15 BATTERY-CYCLE WARRANTY MONITORING

- A. Description: Electronic device, acceptable to battery manufacturer as a basis for warranty action, for monitoring of charge-discharge cycle history of batteries covered by cycle-life warranties.
- B. Performance: Automatically measure and record each discharge event, classify it according to duration category and total discharges according to warranty criteria, and display remaining warranted battery life on front panel display.
- C. Additional monitoring functions and features shall include the following:
 1. Measuring and Recording: Total voltage at battery terminal. Initiate an alarm for excursions outside the proper float-voltage level.
 2. Monitoring: Ambient temperature at battery; initiate an alarm if temperature deviates from normally acceptable range.
 3. Keypad on Device Front Panel: Provide access to monitored data using front panel display.
 4. Alarm Contacts: Arrange to initiate remote alarm for abnormal battery voltage or temperature.
 5. Memory: Store recorded data in nonvolatile electronic memory.
 6. Ethernet Port: Permits downloading of data to a PC.

2.16 SOURCE QUALITY CONTROL

- A. Factory test complete UPS system before shipment. Use the same type of batteries that are part of final installation. Include the following:
 1. Test and demonstration of all functions, controls, indicators, sensors, and protective devices.
 2. Full-load test.

SECTION 263353 - STATIC UNINTERRUPTIBLE POWER SUPPLY (continued):

3. Transient-load response test.
4. Overload test.
5. Power failure test.

B. Report test results. Include the following data:

1. Description of input source and output loads used. Describe actions required to simulate source load variation and various operating conditions and malfunctions.
2. List of indications, parameter values, and system responses considered satisfactory for each test action. Include tabulation of actual observations during test.
3. List of instruments and equipment used in factory tests.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for conditions affecting performance of the UPS.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Verify installation conditions are representative of the conditions used in the coordination studies for the electrical system. Provide fuse protection according to Section 262813 "Fuses" if required for coordination with UPS overcurrent protective device requirements.

3.02 INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Install cables in raceways except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
 1. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
 2. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- D. Equipment Mounting: Install UPS on concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base 6 inches (150 mm) from the outer edge of the base.
 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.

SECTION 263353 - STATIC UNINTERRUPTIBLE POWER SUPPLY (continued):

- E. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.
- F. Connections: Interconnect system components. Make connections to supply and load circuits according to manufacturer's wiring diagrams unless otherwise indicated. Apply oxide inhibitor on battery terminals.

3.03 GROUNDING

- A. Separately Derived Systems:
 - 1. Comply with manufacturer's written instructions that include grounding requirements in excess of NFPA 70 requirements for connecting to grounding electrodes and for bonding to metallic piping near isolation transformer. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.04 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 - 1. Identify each battery cell individually.

3.05 BATTERY EQUALIZATION

- A. Equalize charging of battery cells according to manufacturer's written instructions. Record individual-cell voltages.

3.06 FIELD QUALITY CONTROL

- A. Adminstrant for Tests and Inspections:
 - 1. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
 - 1. Inspect interiors of enclosures, including the following:
 - a. Inspect anchorage, alignment, grounding, and required clearances.
 - b. Component type and labeling verification.
 - c. Ratings of installed components.
 - 2. Test electrical and mechanical interlock systems for correct operation and sequencing.
 - 3. Inspect bolted electrical connections for high resistance using one or more of the following methods:
 - a. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or Table 100.12 of NETA ATS.
 - 4. Test static transfer from inverter to bypass and back. Use normal load, if possible.

SECTION 263353 - STATIC UNINTERRUPTIBLE POWER SUPPLY (continued):

5. Test dc undervoltage trip level on inverter input breaker. Set according to manufacturer's published data.
 6. Verify synchronizing indicators for static switch and bypass switches.
 7. Test direct current system's batteries.
 - a. Verify adequacy of battery support racks, mounting, anchorage, alignment, grounding, and clearances.
 - b. Inspect spill containment installation. Measure charger float and equalizing voltage levels. Adjust to battery manufacturer's recommended settings.
 - c. Verify all charger functions and alarms.
 - d. Measure each cell voltage and total battery voltage with charger energized and in float mode of operation.
 - e. Perform a load test according to manufacturer's published data or IEEE 450.
 - f. Measure charger float and equalizing voltage levels. Adjust to battery manufacturer's recommended settings.
 - g. Test values.
 - 1) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Charger float and equalize voltage levels shall be according to battery manufacturer's published data.
 - 3) The results of charger functions and alarms shall be according to manufacturer's published data.
 - 4) Cell voltages shall be within 0.05 V of each other or according to manufacturer's published data.
 - 5) Cell internal ohmic values (resistance, impedance, or conductance) shall not vary by more than 25 percent between identical cells that are in a fully charged state.
 - 6) Results of load tests shall be according to manufacturer's published data or IEEE 450.
 8. Test communication of status and alarms to remote monitoring equipment.
- C. 260548.16"SeismicControlsforElectricalSystems."
- D. The UPS system will be considered defective if it does not pass tests and inspections.
- E. Record of Tests and Inspections: Maintain and submit documentation of tests and inspections, including references to manufacturers' written instructions and other test and inspection criteria. Include results of tests, inspections, and retests.
- F. Prepare test and inspection reports.
- 3.07 **DEMONSTRATION**
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the UPS.

END OF SECTION 263353

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SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes automatic transfer switches rated 600 V and less, including the following:
 - 1. Bypass/isolation switches.
 - 2. Remote annunciator system.

1.03 ACTION SUBMITTALS

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

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.05 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA ICS 1.
- C. Comply with NFPA 110.
- D. Comply with UL 1008 unless requirements of these Specifications are stricter.

SECTION 263600 - TRANSFER SWITCHES (continued):

- E. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- F. Tested Fault-Current Closing and Short-Circuit Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
 - 1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
 - 2. Short-time withstand capability for three cycles.
- G. Repetitive Accuracy of Solid-State Controls: All settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- H. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- I. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes shall be mechanically and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.
- J. Service-Rated Transfer Switch:
 - 1. Comply with UL 869A and UL 489.
 - 2. Provide terminals for bonding the grounding electrode conductor to the grounded service conductor.
 - 3. In systems with a neutral, the bonding connection shall be on the neutral bus.
 - 4. Provide removable link for temporary separation of the service and load grounded conductors.
 - 5. Surge Protective Device: Service rated.
 - 6. Ground-Fault Protection: Comply with UL 1008 for normal bus.
 - 7. Service Disconnecting Means: Externally operated, manual mechanically actuated.
- K. Neutral Switching: Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.
- L. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.
- M. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, by color-code or by numbered or lettered wire and cable with printed markers at terminations. Color-coding and wire and cable markers are specified in Section 260553 "Identification for Electrical Systems."
 - 1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
 - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
 - 4. Accessible via front access.
- N. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

SECTION 263600 - TRANSFER SWITCHES (continued):

2.02 CONTACTOR-TYPE AUTOMATIC TRANSFER SWITCHES

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1. [Caterpillar, Inc.; Electric Power Division.](#)
 - 2. [Cummins Power Generation.](#)
 - 3. [Eaton.](#)
 - 4. [Kohler Power Systems.](#)
 - 5. [Vertiv, Co. \(ASCO\).](#)
- B. Comply with Level 1 equipment according to NFPA 110.
- C. **Switch Characteristics:** Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. **Limitation:** Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are unacceptable.
 - 2. **Switch Action:** Double throw; mechanically held in both directions.
 - 3. **Contacts:** Silver composition or silver alloy for load-current switching. Contactor-style automatic transfer-switch units, rated 600 A and higher, shall have separate arcing contacts.
 - 4. **Conductor Connectors:** Suitable for use with conductor material and sizes.
 - 5. **Material:** Hard-drawn copper, 98 percent conductivity.
 - 6. **Main and Neutral Lugs:** Compression type.
 - 7. **Ground Lugs and Bus-Configured Terminators:** Compression type.
 - 8. **Connectors** shall be marked for conductor size and type according to UL 1008.
- D. **Automatic Open-Transition Transfer Switches:** Interlocked to prevent the load from being closed on both sources at the same time.
 - 1. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.
- E. **Electric Nonautomatic Switch Operation:** Electrically actuated by push buttons designated "Normal Source" and "Alternative Source." Switch shall be capable of transferring load in either direction with either or both sources energized.
- F. **Signal-Before-Transfer Contacts:** A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval shall be adjustable from 1 to 30 seconds.
- G. **Digital Communication Interface:** Matched to capability of remote annunciator or annunciator and control panel.
- H. **Automatic Transfer-Switch Controller Features:**
 - 1. Controller operates through a period of loss of control power.
 - 2. **Undervoltage Sensing for Each Phase of Normal and Alternate Source:** Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage shall be adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
 - 3. **Voltage/Frequency Lockout Relay:** Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.

SECTION 263600 - TRANSFER SWITCHES (continued):

4. Time Delay for Retransfer to Normal Source: Adjustable from zero to 30 minutes, and factory set for 10 minutes. Override shall automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods shall be adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
 - a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
 - b. Push-button programming control with digital display of settings.
 - c. Integral battery operation of time switch when normal control power is unavailable.

2.03 TRANSFER SWITCH ACCESSORIES

A. Bypass/Isolation Switches:

1. Source Limitations: Same manufacturer as transfer switch in which installed.
2. Comply with requirements for Level 1 equipment according to NFPA 110.
3. Description: Manual type, arranged to select and connect either source of power directly to load, isolating transfer switch from load and from both power sources. Include the following features for each combined automatic transfer switch and bypass/isolation switch:
 - a. Means to lock bypass/isolation switch in the position that isolates transfer switch with an arrangement that permits complete electrical testing of transfer switch while isolated. Interlocks shall prevent transfer-switch operation, except for testing or maintenance, while automatic transfer switch is isolated.
 - b. Provide means to make power available to transfer-switch control circuit for testing and maintenance purposes.
 - c. Drawout Arrangement for Transfer Switch: Provide physical separation from live parts and accessibility for testing and maintenance operations. Transfer switch and bypass/isolation switch shall be in isolated compartments.

SECTION 263600 - TRANSFER SWITCHES (continued):

- d. Transition: Provide closed-transition operation when transferring from main transfer switch to bypass/isolation switch on the same power source.
 - e. Transition: Provide open-transition operation when transferring between power sources.
 - f. Bypass/Isolation Switch Current, Voltage, Closing, and Short-Circuit Withstand Ratings: Equal to or greater than those of associated automatic transfer switch, and with same phase arrangement and number of poles.
 - g. Contact temperatures of bypass/isolation switches shall not exceed those of automatic transfer-switch contacts when they are carrying rated load.
 - h. Automatic and Nonautomatic Control: Automatic transfer-switch controller shall also control the bypass/isolation switch.
 - i. Legend: Manufacturer's standard legend for control labels and instruction signs shall describe operating instructions.
 - j. Maintainability: Fabricate to allow convenient removal of major components from front without removing other parts or main power conductors.
4. Interconnection of Bypass/Isolation Switches with Automatic Transfer Switches: Factory-installed copper bus bars; plated at connection points and braced for the indicated available short-circuit current.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Floor-Mounting Switch: Anchor to floor by bolting.
 - 1. Install transfer switches on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Division 03 "Cast-in-Place Concrete."
 - 2. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
 - 3. Provide workspace and clearances required by NFPA 70.
- B. Annunciator and Control Panel Mounting: Flush in wall unless otherwise indicated.
- C. Identify components according to Section 260553 "Identification for Electrical Systems."
- D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.
- E. Comply with NECA 1.

3.02 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to generator sets, control, and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
- B. Wiring Method: Install cables in raceways and cable trays except within electrical enclosures. Conceal raceway and cables except in unfinished spaces.
 - 1. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

SECTION 263600 - TRANSFER SWITCHES (continued):

- D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- F. Connect twisted pair cable according to Section 260523 "Control-Voltage Electrical Power Cables."
- G. Route and brace conductors according to manufacturer's written instructions. and Section 260529 "Hangers and Supports for Electrical Systems." Do not obscure manufacturer's markings and labels.
- H. Final connections to equipment shall be made with liquidtight, flexible metallic conduit no more than 18 inches (457 mm) in length.

3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
 - 1. After installing equipment, test for compliance with requirements according to NETA ATS.
 - 2. Visual and Mechanical Inspection:
 - a. Compare equipment nameplate data with Drawings and Specifications.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage, alignment, grounding, and required clearances.
 - d. Verify that the unit is clean.
 - e. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
 - f. Verify that manual transfer warnings are attached and visible.
 - g. Verify tightness of all control connections.
 - h. Inspect bolted electrical connections for high resistance using one of the following methods, or both:
 - 1) Use of low-resistance ohmmeter.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data.
 - i. Perform manual transfer operation.
 - j. Verify positive mechanical interlocking between normal and alternate sources.
 - k. Perform visual and mechanical inspection of surge arresters.
 - l. Inspect control power transformers.
 - 1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
 - 2) Verify that primary and secondary fuse or circuit-breaker ratings match Drawings.
 - 3) Verify correct functioning of drawout disconnecting contacts, grounding contacts, and interlocks.
 - 3. Electrical Tests:
 - a. Verify settings and operation of control devices.
 - b. Calibrate and set all relays and timers.
 - c. Verify phase rotation, phasing, and synchronized operation.
 - d. Perform automatic transfer tests.
 - e. Verify correct operation and timing of the following functions:

SECTION 263600 - TRANSFER SWITCHES (continued):

- 1) Normal source voltage-sensing and frequency-sensing relays.
 - 2) Engine start sequence.
 - 3) Time delay on transfer.
 - 4) Alternative source voltage-sensing and frequency-sensing relays.
 - 5) Automatic transfer operation.
 - 6) Interlocks and limit switch function.
 - 7) Time delay and retransfer on normal power restoration.
 - 8) Engine cool-down and shutdown feature.
4. After energizing circuits, perform each electrical test for transfer switches stated in NETA ATS and demonstrate interlocking sequence and operational function for each switch at least three times.
- a. Simulate power failures of normal source to automatic transfer switches and retransfer from emergency source with normal source available.
 - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
 - c. Verify time-delay settings.
 - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
 - e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
 - f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
- B. Coordinate tests with tests of generator and run them concurrently.
- C. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- D. Transfer switches will be considered defective if they do not pass tests and inspections.
- E. Remove and replace malfunctioning units and retest as specified above.
- F. Prepare test and inspection reports.
- 3.04 **DEMONSTRATION**
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.
- B. Coordinate this training with that for generator equipment.

END OF SECTION 263600

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SECTION 264313 - SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Type 2 surge protective devices.
 - 2. Enclosures.
 - 3. Conductors and cables.

1.02 DEFINITIONS

- A. I_n : Nominal discharge current.
- B. Maximum Continuous Operating Voltage (MCOV): The maximum designated RMS value of the power frequency voltage that may be continuously applied to the mode of protection of an SPD.
- C. Metal-Oxide Varistor (MOV): An electronic component with a significant bidirectional, nonlinear current-voltage characteristic.
- D. Mode(s), Modes of Protection, or Protection Modes: Electrical paths where the SPD offers defense against transient overvoltages. Examples include: line to neutral (L-N), line to ground (L-G), line to line (L-L), and neutral to ground (N-G).
- E. SCCR: Short-circuit current rating.
- F. Type 1 SPDs: Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service disconnect overcurrent device.
- G. Type 2 SPDs: Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device, including SPDs located at the branch panel.
- H. Type 3 SPDs: Point of utilization SPDs.
- I. Type 4 SPDs: Component SPDs, including discrete components, as well as assemblies.
- J. Type 5 SPDs: Discrete component surge suppressors, such as MOVs that may be mounted on a printed wiring board, connected by its leads or provided within an enclosure with mounting means and wiring terminations.
- K. Voltage Protection Rating (VPR): A rating selected from UL 1449 list of preferred values assigned to each mode of protection.

1.03 ACTION SUBMITTALS

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

SECTION 264313 - SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS (continued):

- a. Include electrical characteristics, specialties, and accessories for SPDs.

1.04 **WARRANTY**

- A. Special Manufacturer Extended Warranty: Manufacturer warrants that SPDs perform in accordance with specified requirements and agrees to provide repair or replacement of SPDs that fail to perform as specified within extended warranty period.
 1. Initial Extended Warranty Period: Five year(s) from date of Substantial Completion, for labor, materials, and equipment.
- B. The manufacturer shall provide unlimited free replacement of the entire SPD (not just modules, components or sub-assemblies) for all inoperable SPDs during the warranty period. Acceptable manufacturers listed that do not meet the warranty as standard shall submit a letter extending the warranty with the product submittal.
 1. Manufacturer's Replacement Policy

PART 2 - **PRODUCTS**

2.01 **TYPE 2 SURGE PROTECTIVE DEVICES (SPDs)**

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 1. ABB, Electrification Business.
 2. Advanced Protection Technologies Inc. (APT).
 3. Eaton.
 4. Liebert; Vertiv Holdings Co.
 5. Mersen USA.
 6. SSI, an ILSCO Company.
 7. Schneider Electric USA, Inc.
 8. Siemens Industry, Inc., Energy Management Division.
- B. Source Limitations: Obtain devices from single source from single manufacturer.
- C. General Characteristics:
 1. Reference Standards: UL 1449, Type 2.
 2. MCOV: Not less than 125 percent of nominal system voltage for 208Y/120 V and 120/240 V power systems, and not less than 115 percent of nominal system voltage for 480Y/277 V power systems.
 3. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase must not be less than 160 kA. Peak surge current rating must be arithmetic sum of the ratings of individual MOVs in a given mode.
 4. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V or 208Y/120 V, three-phase, four-wire circuits must not exceed the following:
 - a. Line to Neutral: 1200 V for 480Y/277 V or 700 V for 208Y/120 V.
 - b. Line to Ground: 1200 V for 480Y/277 V or 700 V for 208Y/120 V.
 - c. Neutral to Ground: 1200 V for 480Y/277 V or 700 V for 208Y/120 V.
 - d. Line to Line: 2000 V for 480Y/277 V or 1200 V for 208Y/120 V.

SECTION 264313 - SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS (continued):

5. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits must not exceed the following:
 - a. Line to Neutral: 700 V.
 - b. Line to Ground: 700 V.
 - c. Neutral to Ground: 700 V.
 - d. Line to Line: 1200 V.
6. SCCR: Equal or exceed 200 kA.
7. I_n Rating: 20 kA.

D. Options:

1. Include LED indicator lights for power and protection status.
2. Include internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Include NEMA ICS 5, dry Form C contacts rated at 2 A and 24 V(ac) for remote monitoring of protection status.
4. Include surge counter.

2.02 TYPE 3, TYPE 4, AND TYPE 5 SURGE PROTECTIVE DEVICES (SPDs)

- A. Type 3, Type 4, and Type 5 SPDs are not approved for field installation.

2.03 ENCLOSURES

- A. Indoor Enclosures: Type 1.
- B. Outdoor Enclosures: Type 4X.

2.04 CONDUCTORS AND CABLES

- A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Provide OCPD and disconnect for installation of SPD in accordance with UL 1449 and manufacturer's instructions.
- B. Install leads between disconnects and SPDs short, straight, twisted, and in accordance with manufacturer's instructions. Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
 1. Do not splice and extend SPD leads unless specifically permitted by manufacturer.
 2. Do not exceed manufacturer's recommended lead length.
 3. Do not bond neutral and ground.

SECTION 264313 - SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS (continued):

- C. Use crimped connectors and splices only. Wire nuts are unacceptable.

3.02 **FIELD QUALITY CONTROL**

- A. Tests and Inspections:
 - 1. Compare equipment nameplate data for compliance with Drawings and the Specifications.
 - 2. Inspect anchorage, alignment, grounding, and clearances.
 - 3. Verify that electrical wiring installation complies with manufacturer's installation requirements.

3.03 **STARTUP SERVICE**

- A. Complete startup checks in accordance with manufacturer's instructions.
- B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests; reconnect them immediately after the testing is over.
- C. Energize SPDs after power system has been energized, stabilized, and tested.

END OF SECTION 264313

SECTION 270100 - GENERAL PROVISIONS FOR COMMUNICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Provisions of this Section apply to all Division 27 Specification Sections.

1.02 SUMMARY

- A. Section includes basic requirements for communication systems.

1.03 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. Furnish: Supply and deliver to project site, ready for subsequent requirements.
- C. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.
- D. Provide: Furnish and install, complete and ready for intended use.
- E. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- F. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.
- G. Concealed Work: Work hidden from view, including inside chases, furred spaces, or above ceilings.
- H. Exposed Work: Work open to view, including inside mechanical and equipment rooms.

1.04 QUALITY ASSURANCE

- A. General:
 - 1. It is the intent of the plans and specifications to obtain a complete, operable and satisfactory installation.
 - 2. All materials shall be new, be properly labeled and/or identified and be in full compliance with the contract documents.
 - 3. All work shall comply with applicable Codes and Standards.

SECTION 270100 - GENERAL PROVISIONS FOR COMMUNICATIONS (continued):

4. Manufacturer's model names and numbers used in these specifications are subject to change per manufacturer's action. Contractor shall therefore verify them with manufacturer's representative before ordering any product or equipment
- B. Furnish new and unused materials and equipment manufactured in the U.S.A. Where two or more units of the same type or class of equipment are required provide units of a single manufacturer.

1.05 CODES AND STANDARDS

- A. Perform work in accordance with the following codes and any applicable statutes, ordinances, codes, and regulations of governmental authorities having jurisdiction.
 1. Occupational Safety and Health Regulations (OSHA).
 2. National Fire Codes
 - a. NFPA 1 Uniform Fire Code – 2021 (Florida Edition)
 - b. NFPA 70 National Electrical Code – 2020
 - c. NFPA 72 National Fire Alarm and Signaling Code - 2019
 - d. NFPA 101 Life Safety Code – 2021 (Florida Edition)
 3. Florida Building Code, 2023 Edition
 - a. Building Code
 - b. Existing Building Code
 - c. Energy Conservation Code
 - d. Mechanical Code
 - e. Plumbing Code
 - f. Fuel Gas Code
 - g. Accessibility Code
 4. Florida Statutes
 - a. Chapter 471 Engineering
 - b. Chapter 533.80 Building Construction Standards; Florida Building Code - Enforcement
 5. Florida Administrative Code
 - a. Chapter 9B-7 Florida Building Commission Handicapped Accessibility Standards
 - b. Chapter 61G15-33 Responsibility Rules of Professional Engineers Concerning the Design of Electrical Systems
 - c. Chapter 69A-3 Fire Prevention – General Provisions
 - d. Chapter 69A-60 The Florida Fire Prevention Code
 6. ADA Accessibility Guidelines for Buildings (ADAAG)
- B. Resolve, in writing, any code violation discovered in contract documents with the Engineer prior to bidding. After award of the contract, make any correction or addition necessary for compliance with applicable codes at no additional cost to Owner.
- C. The Contractor shall include in the Work, without extra cost to the Owner, any labor, materials, services, apparatus, and drawings required to comply with all applicable laws, ordinances, rules, and regulations.
- D. Where there is conflict between the Contract Documents and the applicable Codes, the Codes shall govern, except where the requirements of the Contract Documents are more stringent.

SECTION 270100 - GENERAL PROVISIONS FOR COMMUNICATIONS (continued):

1.06 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or NEC Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments, or supplements in effect on date bids are received. Specifications and standards are minimum requirements for all equipment, material and work. In instances where capacities, size or other feature of equipment, devices or materials exceed these minimums, meet listed or shown capacities.
- B. Whenever a reference is made to a standard, installation and materials shall comply with the latest published edition of the standard at the time project is bid unless otherwise specified herein

1.07 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.

1.08 PERMITS FEES AND INSPECTIONS

- A. Obtain and pay for all permits, fees, tap fees, connection charges, demand charges, systems charges, impact fees, and inspections.
- B. Deliver all certificates of inspection issued by authorities having jurisdiction to the Engineer.

1.09 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for direction before proceeding.
 - 1. If discrepancies or conflicts occur between drawings, or between drawings and specifications, notify the Engineer in writing prior to bid date; however, the most stringent requirement shall govern.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.10 SUBMITTALS

- A. Submittals (including Product Data, Shop Drawings, and any other Action Submittal or Information Submittal) will only be reviewed if they are submitted in full accordance with the General and Supplementary Conditions, Division 01, and the following:
 - 1. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

SECTION 270100 - GENERAL PROVISIONS FOR COMMUNICATIONS (continued):

2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are approved by the Engineer.
 3. Submittals shall only contain relevant product data. Remove or strikeout irrelevant product data.
 4. Prepare submittals as PDF electronic files and electronically transmit to Engineer through email or web-based project software site, in accordance with Division 01 Specification Sections. Submittals shall be in searchable PDF format and not a scanned copy.
 5. Options: Identify options requiring selection by Engineer.
 6. Deviations: Clearly identify deviations from requirements in the Contract Documents, including minor variations and limitations.
 7. Revisions: Include relevant additional information and revisions, other than those specifically requested by Engineer on previous submittals. Indicate by highlighting on each submittal or noting on attached submittal sheet.
 8. Contractor's Review:
 - a. Submittals shall have been reviewed and approved by the General Contractor / Construction Manager. Include approval stamp, 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.
 - b. Engineer will not review submittals received from Contractor that do not have Contractor's review and approval.
 9. Electrical Modifications:
 - a. The electrical design indicated on the plans supports the Basis of Design specifications for the Communications systems at the time of design.
 - b. If Communications equipment is submitted with different electrical requirements, it is the responsibility of the Contractor to resolve all required electrical design changes, including, but not limited to: wire and conduit size, type or size of disconnect or overload protection, breaker coordination, point(s) of connection, etc. Any corrections required shall be provided at no additional cost.
 - c. Submittal shall clearly show the electrical design revisions with a written statement that this change will be provided at no additional cost. Submittals made with no written reference to the electrical design revisions will be presumed to work with the electrical design.
- B. Processing Time: Allow 15 days for submittal review. Time of review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of the failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. The Contractor shall not be relieved of responsibility for deviations from requirements of the contract documents by the Engineer's approval of shop drawings, product data, samples, or similar submittals unless the Contractor has specifically informed the Engineer in writing of such deviation at the time of submittal, and the Engineer has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in shop drawings, product data, samples, or similar submittals by the Engineer's approval thereof.
- D. Submittals on any particular phase of Work will receive only one review and one re-review (if required). If additional reviews are required beyond these two, the Contractor will be charged \$120.00 per hour for review time. This fee shall be paid to the Engineer prior to Submittal release.

SECTION 270100 - GENERAL PROVISIONS FOR COMMUNICATIONS (continued):

1.11 SUBSTITUTIONS

- A. By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.
- B. Substitution Requests shall include, at a minimum:
 - 1. Statement indicating why specified material, equipment, or installation method cannot be provided, if applicable.
 - 2. Coordination of information, including a list of changes and 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.
 - 3. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include an 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.
 - 4. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - 5. 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.
 - 6. Cost information, including a proposal of change, if any, in the Contract Sum.
 - 7. 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.
 - 8. 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.
- C. Procurement Substitution Requests submitted prior to receipt of bids will be received and considered by Owner when the following conditions are satisfied, as determined by Engineer; otherwise, requests will be returned without action:
 - 1. Requests for substitution of materials and equipment are received no later than 10 days prior to date of bid opening.
 - 2. Extensive revisions to the Contract Documents are not required.
 - 3. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.
 - 4. The request is fully documented and properly submitted.
- D. Substitutions for Cause, as required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms will be received and considered by Engineer, only when the following conditions are satisfied; otherwise, requests will be returned without action, except to record noncompliance with these requirements:
 - 1. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - 2. Substitution request is fully documented and properly submitted.
 - 3. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - 4. Requested substitution is compatible with other portions of the Work.
 - 5. Requested substitution has been coordinated with other portions of the Work.
 - 6. Requested substitution provides specified warranty.

SECTION 270100 - GENERAL PROVISIONS FOR COMMUNICATIONS (continued):

7. 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.
- E. Substitutions for Convenience, not required in order to meet other Project requirements but may offer advantage to Contractor or Owner, will be received and considered by Owner, as determined by Engineer, only when the following conditions are satisfied; otherwise, requests will be returned without action, except to record noncompliance with these requirements:
1. Requested substitution is received within 60 days after the Notice of Award.
 2. 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 Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 3. Requested substitution does not require extensive revisions to the Contract Documents.
 4. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 5. Substitution request is fully documented and properly submitted.
 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 7. Requested substitution is compatible with other portions of the Work.
 8. Requested substitution has been coordinated with other portions of the Work.
 9. Requested substitution provides specified warranty.
 10. 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.
- F. If a requested substitution is approved but contains differences or omissions not specifically identified to the attention of the Engineer in the substitution request, the Owner reserves the right to require equal or similar features to be added to the substituted products or to have the substituted products replaced at the Contractor's expense.

1.12 PROJECT RECORD DOCUMENTS

- A. Recording: Maintain one copy of the Contract Documents and Shop Drawings during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Preparation:
1. Contract Drawings and Shop Drawings:
 - a. Mark revisions to show where the actual installation varies from that shown originally.
 - b. Mark record sets completely and accurately, including important information that was either shown schematically or omitted from original Drawings.
 - c. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - d. Record underground and under-slab piping installed, dimensioning exact location and elevation of piping.
 2. Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 3. Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

SECTION 270100 - GENERAL PROVISIONS FOR COMMUNICATIONS (continued):

- C. Deliver: Prior to Final Completion, provide record documents to Owner as indicated below:
1. Record Drawings: Submit PDF electronic files of scanned record prints and one set of prints.
 2. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
 3. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
 4. Miscellaneous Record Submittals: Submit annotated PDF electronic files directories of each submittal.

1.13 OPERATION AND MAINTENANCE MANUALS

- A. Prepare and submit a comprehensive manual of emergency, operation, and maintenance data and materials in full accordance with the General and Supplementary Conditions, Division 01, and the following:
1. Operations and Maintenance Manuals: Assemble a complete set of data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system, including:
 - a. Information required for daily operation and management, operating standards, and routine and special operating procedures.
 - b. Manufacturers' maintenance documentation, preventative maintenance procedures and frequency, repair procedures, wiring and systems diagrams, list of spare parts, and warranty information.
 2. Submit manuals as PDF electronic files and electronically transmit to Engineer through email or web-based project software site, in accordance with Division 01 Specification Sections. Submittals shall be in searchable PDF format and not a scanned copy.

1.14 DEMONSTRATION AND TRAINING

- A. Prepare and provide services of qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not a part of a system in accordance with the General and Supplementary Conditions, Division 01, individual Specification Sections, and the following:
1. Demonstration and training shall occur upon completion of the Work and at a time designated by the Owner's representative.
 2. Provide a high-resolution, digital video recording of each training session to the Owner.

1.15 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

1.16 WARRANTY

- A. Warranty work and equipment within specified warranty period. During the warranty period, provide labor and materials to make good any faults or imperfections that may arise due to defects or omissions in materials or workmanship without expense to the Owner.

SECTION 270100 - GENERAL PROVISIONS FOR COMMUNICATIONS (continued):

1. Warranty Period: One year from date of Substantial Completion.
- B. 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 Contract Documents.
- C. Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond nor relieving the Contractor of responsibilities during the warranty period.

PART 2 - EXECUTION

2.01 CONTRACT DOCUMENTS

- A. Examine all drawings and specifications carefully before submitting a bid. Architectural drawings take precedence over mechanical or electrical drawings with reference to building construction.
- B. For purposes of clearness and legibility, drawings are essentially diagrammatic and, although size and location of equipment are drawn to scale wherever possible, Contractor shall make use of all data in all of the contract documents and shall verify this information at the building site.
- C. The drawings indicate required size and points of termination of pipes, conduits, and ducts and suggest proper routes to conform to structure avoid obstructions and preserve clearances. However, it is not intended that drawings indicate all necessary offsets, and it shall be the responsibility of the Contractor to make the installation in such a manner as to conform to structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further instructions or cost to the Owner.
- D. Furnish, install and/or connect with appropriate services all items shown on any drawing without additional compensation.
- E. Any and all questions about a subcontractor's scope of work responsibility shall be addressed to and answered by the General Contractor / Construction Manager.
- F. Questions About Construction Documents: Any and all questions shall be submitted through the proper channels IN WRITING and, in turn, shall be answered by the Engineer in writing. All telephone conversations shall be considered unofficial and, as such, shall not be considered official or binding responses to Contractor's questions.
- G. Drawings, specifications, or other documents issued by the Engineer in electronic format and/or electronic media are provided for convenience only and are not intended for use as Contract Documents.
 1. The electronic files are provided merely as a convenience to the Recipient.
 2. The electronic files do not replace or supplement the paper copies of any drawings, specifications, or other documents included in the Contract Documents for use on the project.
 3. The Engineer makes no representation, warranty, or guarantee that electronic files:
 - a. Are suitable for any other usage or purpose.
 - b. Have any particular durability.
 - c. Will not damage or impair the Recipient's computer or software.
 - d. Contain no errors or mechanical flaws or other discrepancies that may render them unsuitable for the purpose intended by the Recipient.

SECTION 270100 - GENERAL PROVISIONS FOR COMMUNICATIONS (continued):

4. Due to the unsecured nature of the electronic files and the inability of Engineer or the Recipient to establish controls over their use, the Engineer assumes no responsibility for any consequences arising out of the use of the data. It is the sole responsibility of the Recipient to check the validity of all information contained therein. The Recipient shall at all times refer to the signed and sealed drawings, specification or other documents for the project during all phases of the project. The Recipient shall assume all risks and liabilities resulting from the use of the electronic files.

2.02 SUPERVISION OF WORK

- A. Perform all work under the direct supervision of an experienced, qualified superintendent. The Engineer has the right to remove a superintendent who, in the Engineer's opinion, is not satisfactory.

2.03 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, mechanical and electrical systems, and other construction affecting the Work.
- 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.
 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. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

2.04 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, 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 caused by differing field conditions outside the control of Contractor, submit a request for information to Engineer.

SECTION 270100 - GENERAL PROVISIONS FOR COMMUNICATIONS (continued):

- E. Interruption of Service: Before any existing equipment or system is shut down for disconnecting or tie-ins, coordinate with Engineer and Owner regarding acceptable dates and times for this Work to be performed. Work shall be performed at the time best suited for the Owner, which typically is either on weekends, holidays, and/or after normal working hours. Services shall be restored the same day unless prior arrangements are made. All overtime or premium costs associated with this Work shall be included in the Contractor's bid.

2.05 INSTALLATION

- A. Install materials and equipment in a professional manner. The Engineer may direct replacement of items which, in the Engineer's opinion, do not present a professional appearance or do not allow adequate space for maintenance. Replace or reinstall items at the expense of the Contractor.
- B. General: 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 (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.
- C. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- D. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- E. 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.
- F. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- G. Obstructions
 - 1. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
 - 2. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided. Verify locations given.
 - 3. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
 - 4. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.
- H. Where "rated" walls, floor, roofs and ceilings are penetrated or cut to install equipment, materials, devices, etc. the Contractor shall provide and install all materials required to re-establish the rating of the wall, floor, roof, or ceiling to the satisfaction of the authority having jurisdiction.

SECTION 270100 - GENERAL PROVISIONS FOR COMMUNICATIONS (continued):

- I. Structural Elements: Do not cut structural elements without written approval from Engineer. Notify Engineer of locations and details of cutting and await directions from Engineer before proceeding. If approved by Engineer:
 - 1. Shore, brace, and support structural elements during cutting and patching.
 - 2. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
- J. Space Requirements: Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material which is not suitable in this respect.
- K. Tools and Equipment: Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions without cost to the Owner.
- L. Phasing: Provide all temporary valves, piping, ductwork, equipment, and devices as required. Maintain temporary services to areas as required. Remove all temporary material and equipment on completion of work unless Engineer concurs that such material and equipment would be beneficial to the Owner on a permanent basis.

2.06 OWNER-INSTALLED PRODUCTS

- A. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

2.07 PROTECTION OF EXISTING FINISHES, CARPET, AND FURNISHING

- A. Protect existing finishes, carpet, casework, furnishing, and other building components against damage and soiling throughout construction activities. Take care during construction not to damage existing items. Contractor shall be responsible for replacing damaged material or restoring damaged materials to the Owner's satisfaction.
- B. When permitted by Engineer, items may be removed to a suitable, protected storage location during construction and cleaned and reinstalled in their original locations after construction operations are complete.
- C. Furniture may be relocated during construction and reinstalled in their original locations after construction operations are complete.
- D. Means and methods for protection are the responsibility of the Contractor. Utilize plywood, polyethylene sheeting, dust cloths, and other means as required.

2.08 UTILITY SERVICES AND COMMUNICATION SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

2.09 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

SECTION 270100 - GENERAL PROVISIONS FOR COMMUNICATIONS (continued):

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Structural Elements: When cutting and patching structural elements, notify Engineer of locations and details of cutting and await directions from Engineer before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
- F. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
- G. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety.
- H. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- I. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- J. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable or with in-place materials.

SECTION 270100 - GENERAL PROVISIONS FOR COMMUNICATIONS (continued):

1. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 2. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials.
- K. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

2.10 PAINTING

- A. Comply with requirements with General and Supplementary Conditions, Division 01, Division 09, and individual Specification Sections.
- B. Touch-up factory finishes on equipment provided under Division 27. Obtain matched color coatings from the manufacturer and apply as directed. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint, as required.
- C. Paint the following work where exposed to view:
1. Metal conduit
 2. Plastic conduit
- D. Paint the following work where exposed in occupied spaces:
1. Other items as directed by Engineer.

2.11 REPAIR OF WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
1. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 2. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

2.12 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

SECTION 270100 - GENERAL PROVISIONS FOR COMMUNICATIONS (continued):

B. Tests

1. Include all tests specified and/or required under laws, rules and regulations of all departments having jurisdiction. Tests shall also be performed as indicated herein and other sections of the specifications.
2. After all systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation. Make adjustments as required to ensure proper functioning of all systems.
3. All parts of the work and associated equipment shall be tested and adjusted to work properly and be left in perfect operating condition.
4. Correct defects disclosed by these tests without any additional cost to the Owner. Repeat tests on repaired or replaced work.
5. Maintain a log of all tests being conducted and have it available for review by the Engineer. Log to indicate date, type of tests, duration, and defects noted and when corrected.
6. Special tests on individual systems are specified under individual Specification Sections.

- 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.

2.13 CLEANING

- A. Progress Cleaning: 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 (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

- B. Final 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. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - b. Remove labels that are not permanent.
 - c. Wipe surfaces of equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

2.14 MAINTENANCE SERVICE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of systems and equipment Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

END OF SECTION 270100

SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Selection and installation of communications busbars.
2. Selection and installation of communications bonding conductors.

1.02 DEFINITIONS

- A. BBC: Backbone bonding conductor, for connecting multiple TBBs serving the same floor.
- B. PBB: Primary bonding busbar, located in main distribution frame room, ideally near electrical service entrance.
- C. RBB: Rack bonding busbar, located in equipment cabinets and racks.
- D. SBB: Secondary bonding busbar, located in intermediate distribution frame rooms.
- E. TBB: Telecommunications bonding backbone, for connecting SBBs to PBB.
- F. TBC: Telecommunications bonding conductor, for connecting PBB to intersystem bonding termination device or busbar at electrical service entrance.
- G. TEBC: Telecommunications equipment bonding conductor, for connecting RBBs to SBBs or PBB.
- H. UBC: Unit bonding conductor, for connecting individual communications equipment to RBBs or SBBs.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.
- B. Inspect test results of grounding system measured at point of TBC connection.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with connection of TBC only after unsatisfactory conditions have been corrected.

SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS (continued):

3.02 SELECTION OF COMMUNICATIONS BUSBARS

- A. Unless otherwise indicated in this Section or on Drawings, provide products specified in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. PBB:
 - 1. Dimensions: 1/4 inch thick by 4 inch high (6.3 mm thick by 100 mm high).
 - 2. Stand-Off Distance: 4 inch (100 mm).
- C. SBB:
 - 1. Dimensions: 1/4 inch thick by 2 inch high (6.3 mm thick by 100 mm high).
 - 2. Stand-Off Distance: 4 inch (100 mm).

3.03 SELECTION OF COMMUNICATIONS BONDING CONDUCTORS

- A. Unless otherwise indicated in this Section or on Drawings, provide products specified in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Communications Busbar Connections:
 - 1. TBC: Not smaller than 3/0 AWG and no smaller than largest TBB.
 - 2. TBB: Not smaller than 2 kcmil per linear ft of conductor length, but not larger than 750 kcmil, unless otherwise indicated on Drawings.
 - 3. BBC: Not smaller than largest TBB to which it is connected unless otherwise indicated on Drawings.
 - 4. TEBC: Not smaller than 2 AWG unless otherwise indicated on Drawings. Provide bolted connectors.
 - 5. UBC: Not smaller than 6 AWG unless otherwise indicated on Drawings. Provide bolted connectors.
 - 6. Bonding Conductors to Structural Steel: Not smaller than 4 AWG unless otherwise indicated on Drawings. Provide bolted clamp connectors.
- C. Cable Tray Connections:
 - 1. Cable Tray Equipment Grounding Conductor: 6 AWG.
 - 2. Cable Tray Bonding Jumper: If not supplied by cable manufacturer, provide bonding jumper not smaller than 6 AWG and not longer than 12 inch (300 mm). If jumper is wire, it must be terminated with lug having one hole and standard barrel for one crimp. If jumper is flexible braid, it must be terminated with one- or two-hole ferrule. Attach with bonding screw or connector provided by cable tray manufacturer.
- D. Underground Connections: Not smaller than 2 AWG. Provide welded connectors, except bolted connectors may be used in handholes or manholes and as otherwise indicated on Drawings.

3.04 INSTALLATION OF BONDING FOR COMMUNICATIONS

- A. Comply with manufacturer's published instructions.
- B. Reference Standards:

SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS (continued):

1. Bonding of Communications: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with BICSI N3.
 2. Consult Architect for resolution of conflicting requirements.
- C. Special Techniques:
1. Busbars:
 - a. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers **12 inch (300 mm)** above finished floor unless otherwise indicated.
 - b. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
 2. Conductors:
 - a. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
 - b. Assemble wire connector to conductor, complying with manufacturer's published instructions and as follows:
 - 1) Use crimping tool and die specific to connector.
 - 2) Pretwist conductor.
 - 3) Apply antioxidant compound to bolted and compression connections.
 - c. Install in straightest and shortest route between origination and termination point, and no longer than required. Bend radius must not be smaller than 10 times diameter of conductor. No single bend may exceed 90 degrees.
 - d. Install without splices.
 - e. Support conductors at not more than **36 inch (900 mm)** intervals.
 - f. Outside telecommunications rooms, install conductors in metric designator 21 (trade size 3/4) PVC-80 conduit until conduit enters telecommunications room. Install bonding conductors in EMT-A or EMT-SS when routed through plenum. Do not install bonding conductors in EMT-S unless otherwise indicated on Drawings.
 - 1) If bonding conductor must be installed in EMT-S or other ferrous metallic raceway, bond conductor to raceway using grounding bushing that complies with Section 270528 "Pathways for Communications Systems," and bond both ends of raceway to SBB.
 3. Provide TBC and terminate ends to PBB and intersystem bonding busbar at electrical service entrance in accordance with Section 250.94, "Bonding for Communication Systems," of NFPA 70.
 4. Busbar Interconnections: Bond SBBs to PBB with TBBs. If more than one TBB is installed, bond TBBs together BBCs where required by TIA-607.
 5. Structural Steel: Where structural steel of steel frame building is readily accessible within room or space, bond each SBB and PBB to vertical steel of building frame.
 6. Communications Enclosures: Bond metallic enclosures of telecommunications equipment with UBCs to nearest SBB or PBB.
 7. Equipment Racks: Bond metallic components of enclosures to RBB using UBCs. Provide top-mounted RBB if not provided by enclosure or rack manufacturer. Bond RBB to SBB with TEBC. Power connection must comply with NFPA 70; equipment grounding conductor in power cord of cord- and plug-connected equipment must be considered supplemental to bonding requirements in this Section.
 8. Shielded Cable: Bond shield of shielded cable to SBB in communications rooms and spaces. Comply with TIA-568.1 and TIA-568.2 when grounding shielded balanced twisted-pair cables.
 9. Primary Protector: Bond to PBB with insulated bonding conductor.

SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS (continued):

10. Electrical Power Panelboards: Where electrical panelboards for communications equipment are located in same room or space, bond each ground bar of panelboard to SBB.
11. Cable Trays: Provide continuous electrical path by installing bonding clips and jumpers. Bond each end to nearest SBB.
12. Ladder Racks: Provide continuous electrical path by installing bonding clips and jumpers. Bond each end to nearest SBB.

3.05 IDENTIFICATION

- A. Comply with Section 270553 "Identification for Communications Systems."
- B. Labels must be preprinted or computer-printed type.
 1. Label PBB(s) with "ts-PBB," where "ts" is telecommunications space identifier for location of PBB.
 2. Label SBB(s) with "ts-SBB," where "ts" is telecommunications space identifier for location of SBB.
 3. Label TBC, TBBs, and BBCs at attachment points with legend: "WARNING! COMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.06 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench according to manufacturer's published instructions.
 2. Test bonding connections of system using AC earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing PBB or SBB, using process recommended by BICSI N1. Conduct tests with facility in operation.
 - a. Measure resistance between PBB and electrical service intersystem termination point. Maximum acceptable value is 100 m Ω .
 - 1) If measured resistance from electrical service equipment to ground exceeds 5 Ω , notify Architect and include recommendations to reduce resistance to ground.
 - b. Measure resistance between SBBs and PBB. Maximum acceptable value is 100 m Ω .
 3. Test for ground loop currents using digital clamp-on ammeter, with full scale not more than 10 A, displaying current in increments of 0.01 A at accuracy of plus or minus 2.0 percent.
 - a. With grounding infrastructure completed and communications system electronics operating, measure current in bonding conductors connected to PBB and to SBBs. Maximum acceptable AC current level is 1 A.
- B. Nonconforming Work:
 1. Communications bonding will be considered defective if it does not pass tests and inspections.
 2. Remove and replace defective units and retest.
- C. Collect, assemble, and submit test and inspection reports.

SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS (continued):

3.07 PROTECTION

- A. After installation, protect busbars and conductors from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 270526

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SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Metal conduits and fittings.
 - 2. Nonmetallic conduits and fittings.
 - 3. Hooks.
 - 4. Boxes, enclosures, and cabinets.
 - 5. Polymer-concrete handholes and boxes for exterior underground cabling.

1.03 DEFINITIONS

- A. GRC: Galvanized rigid conduit.

1.04 ACTION SUBMITTALS

- A. Product data for the following:
 - 1. Surface pathways
 - 2. Wireways and fittings.
 - 3. Boxes, enclosures, and cabinets.
 - 4. Underground handholes and boxes.

PART 2 - PRODUCTS

2.01 METAL CONDUITS AND FITTINGS

- A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.
- B. General Requirements for Metal Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
 - 2. Comply with TIA-569-D.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. EMT: Comply with ANSI C80.3 and UL 797.

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS (continued):

- E. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: compression.
- F. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS AND FITTINGS

- A. Description: Nonmetallic raceway of circular section with manufacturer-fabricated fittings.
- B. General Requirements for Nonmetallic Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
 - 2. Comply with TIA-569-D.
- C. RNC: Type EPC-40-PVC and Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. Fittings: Comply with NEMA TC 3; match to conduit or tubing type and material.
- E. Solvents and Adhesives: As recommended by conduit manufacturer.

2.03 HOOKS

- A. Description: Prefabricated sheet metal cable supports for telecommunications cable.
- B. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- C. Comply with TIA-569-D.
- D. Galvanized steel.
- E. J shape.

2.04 BOXES, ENCLOSURES, AND CABINETS

- A. Description: Enclosures for communications.
- B. General Requirements for Boxes, Enclosures, and Cabinets:
 - 1. Comply with TIA-569-D.
 - 2. Boxes, enclosures, and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS (continued):

3. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
 4. Device Box Dimensions: 4 11/16 inches square by 3-1/4 inches deep (102 mm square by 83 mm deep).
 5. Gangable boxes are prohibited.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Metal Floor Boxes:
1. Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 4 <, with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- H. Cabinets:
1. NEMA 250, Type 12 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 2. Hinged door in front cover with flush latch and concealed hinge.
 3. Key latch to match panelboards.
 4. Metal barriers to separate wiring of different systems and voltage.
 5. Accessory feet where required for freestanding equipment.
 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.05 POLYMER-CONCRETE HANDHOLES

- A. Description: Molded of sand and aggregate; bound together with polymer resin; and reinforced with steel, fiberglass, or a combination of the two.
- B. General Requirements for Polymer Concrete Handholes:
1. Boxes and handholes for use in underground systems shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
 3. Comply with TIA-569-D.
- C. Configuration: Designed for flush burial with integral closed bottom unless otherwise indicated.
- D. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
1. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS (continued):

2. Cover Legend: Molded lettering, "COMMUNICATIONS".
- E. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
- F. Handholes **12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long)** and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

PART 3 - EXECUTION

3.01 PATHWAY APPLICATION

- A. Outdoors: Apply pathway products as specified below unless otherwise indicated:
 1. Exposed Conduit: GRC.
 2. Concealed Conduit, Aboveground: GRC.
 3. Underground Conduit: RNC, Type EPC-40-PVC, concrete encased.
 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 4 stainless steel.
- B. Indoors: Apply pathway products as specified below unless otherwise indicated:
 1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed and Subject to Severe Physical Damage: GRC. Pathway locations include the following:
 - a. Loading dock.
 - b. Mechanical rooms.
 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 4. Damp or Wet Locations: GRC.
 5. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
 6. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: EMT.
 7. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: EMT.
 8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel units in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Pathway Size: **1 inch (25 mm)**.
- D. Pathway Fittings: Compatible with pathways and suitable for use and location.
 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
- E. Install surface pathways only where indicated on Drawings.
- F. Do not install nonmetallic conduit where ambient temperature exceeds **120 deg F (49 deg C)**.

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS (continued):

3.02 INSTALLATION

- A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:
 - 1. NECA 1.
 - 2. NECA/BICSI 568.
 - 3. TIA-569-D.
 - 4. NECA 101
 - 5. NECA 105.
- B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- C. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- D. Comply with requirements in Section 270529 "Hangers and Supports for Communications Systems" for hangers and supports.
- E. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling" for sleeves and sleeve seals for communications.
- F. Keep pathways at least **6 inches (150 mm)** away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- G. Complete pathway installation before starting conductor installation.
- H. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- I. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within **12 inches (300 mm)** of changes in direction. Utilize long radius ells for all optical-fiber cables.
- J. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- K. Support conduit within **12 inches (300 mm)** of enclosures to which attached.
- L. Pathways Embedded in Slabs:
 - 1. Run conduit larger than **1-inch (27-mm)** trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum **10-foot (3-m)** intervals.
 - 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings. Comply with requirements for expansion joints specified in this article.
 - 3. Arrange pathways to keep a minimum of **2 inches (50 mm)** of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 - 5. Change from nonmetallic conduit and fittings to GRC and fittings before rising above floor.
- M. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for pathways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS (continued):

- N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- O. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- P. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.
- Q. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.
- R. Cut conduit perpendicular to the length. For conduits of 2-inch (50-mm) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- S. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.
- T. Surface Pathways:
 - 1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
 - 2. Install surface pathway with a minimum 2-inch (50-mm) radius control at bend points.
 - 3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- U. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
 - 1. 1-Inch (25-mm) Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23 m).
 - 2. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- V. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway-sealing fittings according to NFPA 70.
- W. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service pathway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- X. Hooks:
 - 1. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS (continued):

2. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.
 3. Hook spacing shall allow no more than **6 inches (150 mm)** of slack. The lowest point of the cables shall be no less than **6 inches (150 mm)** adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
 4. Space hooks no more than **4 feet (1.2 m)** o.c.
 5. Provide a hook at each change in direction.
- Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- AA. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.
- BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- DD. Set metal floor boxes level and flush with finished floor surface.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe of less than **6 inches (150 mm)** in nominal diameter.
 2. Install backfill as specified in Section 312000 "Earth Moving."
 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within **12 inches (300 mm)** of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
 4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with **3 inches (75 mm)** of concrete around conduit for a minimum of **12 inches (300 mm)** on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of **60 inches (1500 mm)** from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
 5. Underground Warning Tape: Comply with requirements in Section 270553 "Identification for Communications Systems."

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS (continued):

3.04 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from **1/2-inch (12.5-mm)** sieve to **No. 4 (4.75-mm)** sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures **1 inch (25 mm)** above finished grade.
- D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
- E. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.05 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.06 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.07 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage or deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

END OF SECTION 270528

SECTION 270529 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Steel slotted support systems for communication raceways.
 - 2. Conduit and cable support devices.
 - 3. Support for conductors in vertical conduit.
 - 4. Structural steel for fabricated supports and restraints.
 - 5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
 - 6. Fabricated metal equipment support assemblies.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities and furnished specialties and accessories.

PART 2 - PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch- (10-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c. in at least one surface.
 - 1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 2. Material for Channel, Fittings, and Accessories: Galvanized steel.
 - 3. Channel Width: [1-5/8 inches (41.25 mm)].
 - 4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 5. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
 - 6. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: Steel clamps, hangers, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored communications conductors or cables in riser conduits.

SECTION 270529 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS (continued):

Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - 2. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
 - 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
 - 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 5. Toggle Bolts: Stainless-steel springhead type.
 - 6. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 - 1. NECA 1.
 - 2. NECA/BICSI 568.
 - 3. TIA-569-D.
 - 4. NECA 101
 - 5. NECA 102.
 - 6. NECA 105.
 - 7. NECA 111.
- B. Comply with requirements in Division 07 for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for pathways specified in Section 270528 "Pathways for Communications Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

SECTION 270529 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS (continued):

- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with single-bolt conduit clamps.

3.02 SUPPORT INSTALLATION

- A. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- B. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten communications items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Use approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Use expansion anchor fasteners.
 - 5. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 - 6. To Light Steel: Sheet metal screws.
 - 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- C. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor communications materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Comply with requirements in Division 09 for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

SECTION 270529 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS (continued):

- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 270529

SECTION 270544 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Sleeves for pathway and cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.
- B. Related Requirements:
 - 1. Division 07 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.03 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 SLEEVES

- A. Wall Sleeves:
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- E. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized-steel sheet.

SECTION 270544 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING (continued):

2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.02 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.
 1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 2. Pressure Plates: Stainless steel.
 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.03 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 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:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Presealed Systems.

2.04 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.05 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
 2. Sealant shall have VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

SECTION 270544 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING (continued):

3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 "Joint Sealants".
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 3. Size pipe sleeves to provide [**1/4-inch (6.4-mm)**] annular clear space between sleeve and pathway or cable unless sleeve seal is to be installed.
 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 5. Install sleeves for floor penetrations. Extend sleeves installed in floors [**2 inches (50 mm)**] above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for **1-inch (25-mm)** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for **1-inch (25-mm)** annular clear space between pathway or cable and sleeve for installing sleeve-seal system.

SECTION 270544 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING (continued):

3.02 **SLEEVE-SEAL-SYSTEM INSTALLATION**

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at pathway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.03 **SLEEVE-SEAL-FITTING INSTALLATION**

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 270544

SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Color and legend requirements for labels and signs.
 - 2. Labels.
 - 3. Tapes.
 - 4. Signs.

1.03 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 70 and TIA 606-B.
- B. Comply with ANSI Z535.4 for safety signs and labels.
- C. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

2.02 COLOR AND LEGEND REQUIREMENTS

- A. Equipment Identification Labels:
 - 1. Black letters on a white field.

2.03 LABELS

- A. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, vinyl flexible labels with acrylic pressure-sensitive adhesive.
- B. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS (continued):

1. Minimum Nominal Size:
 - a. 1-1/2 by 6 inches (37 by 150 mm) for raceway and conductors.
 - b. 3-1/2 by 5 inches (76 by 127 mm) for equipment.
 - c. As required by authorities having jurisdiction.

2.04 SIGNS

- A. Laminated-Acrylic or Melamine-Plastic Signs:
 1. Engraved legend.
 2. Thickness:
 - a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
 - b. For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.
 - c. Engraved legend with black letters on white face.
 - d. Self-adhesive.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.05 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

PART 3 - EXECUTION

3.01 PREPARATION

- A. Self-Adhesive Identification Products: Before applying communications identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.02 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of communications systems and connected items.

SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS (continued):

- G. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- H. Self-Adhesive Wraparound Labels:
 - 1. Secure tight to surface at a location with high visibility and accessibility.
 - 2. Provide label **6 inches (150 mm)** from cable end.
- I. Self-Adhesive Labels:
 - 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide a single line of text with **1/2-inch- (13-mm-)** high letters on **1-1/2-inch- (38-mm-)** high label; where two lines of text are required, use labels **2 inches (50 mm)** high.
- J. Underground-Line Warning Tape:
 - 1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at **6 to 8 inches (150 to 200 mm)** below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds **16 inches (400 mm)** overall.
 - 2. Limit use of underground-line warning tape to direct-buried cables.
 - 3. Install underground-line warning tape for direct-buried cables and cables in raceways.

3.03 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations with high visibility. Identify by system and circuit designation.
- C. Accessible Fittings for Raceways and Cables within Buildings: Identify covers of each junction and pull box with self-adhesive labels containing wiring system legend.
 - 1. System legends shall be as follows:
 - a. Telecommunications.
- D. Faceplates: Label individual faceplates with self-adhesive labels. Place label at top of faceplate. Each faceplate shall be labeled with its individual, sequential designation, numbered clockwise when entering room from primary egress, composed of the following, in the order listed:
 - 1. Wiring closet designation.
 - 2. Colon.
 - 3. Faceplate number.
- E. Equipment Room Labeling:
 - 1. Racks, Frames, and Enclosures: Identify front and rear of each with self-adhesive labels containing equipment designation.
 - 2. Patch Panels: Label individual rows and outlets, starting at to left and working down, with self-adhesive labels.

SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS (continued):

3. Data Outlets: Label each outlet with a self-adhesive label indicating the following, in the order listed:
 - a. Room number being served.
 - b. Colon.
 - c. Faceplate number.
- F. Backbone Cables: Label each cable with a self-adhesive wraparound label indicating the location of the far or other end of the backbone cable. Patch panel or punch down block where cable is terminated should be labeled identically.
- G. Horizontal Cables: Label each cable with a self-adhesive wraparound label indicating the following, in the order listed:
 1. Room number.
 2. Colon.
 3. Faceplate number.
- H. Locations of Underground Lines: Underground-line warning tape for copper, coaxial, hybrid copper/fiber, and optical-fiber cable.
- I. Instructional Signs: Self-adhesive labels.
- J. Equipment Identification Labels:
 1. Indoor Equipment: Laminated-acrylic or melamine-plastic sign].
 2. Outdoor Equipment: Laminated-acrylic or melamine-plastic sign.
 3. Equipment to Be Labeled:
 - a. Communications cabinets.
 - b. Uninterruptible power supplies.
 - c. Computer room air conditioners.
 - d. Fire-alarm and suppression equipment.
 - e. Egress points.
 - f. Power distribution components.

END OF SECTION 270553

SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Backboards.

1.03 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.

PART 2 - PRODUCTS

2.01 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm).
- B. Backboard Paint: Light-colored fire-retardant paint.

PART 3 - EXECUTION

3.01 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

3.02 INSTALLATION

- A. Comply with NECA 1.
- B. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS (continued):

- C. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.
- D. Backboards:
 - 1. Install from 6 inches (150 mm) to 8 feet, 6 inches (2588 mm) above finished floor. If plywood is fire rated, ensure that fire-rating stamp is visible after installation.
 - 2. Paint all sides of backboard with two coats of paint, leaving fire rating stamp visible.
 - 3. Comply with requirements for backboard installation in BICSI's "Information Technology Systems Installation Methods Manual" and TIA-569-D.

END OF SECTION 271100

SECTION 271116 - COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. 19-inch equipment racks.
 - 2. Power strips.
 - 3. Grounding.
 - 4. Labeling.

1.03 DEFINITIONS

- A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.
- B. BICSI: Building Industry Consulting Service International.
- C. LAN: Local area network.
- D. RCDD: Registered communications distribution designer.
- E. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.
- F. TGB: Telecommunications grounding bus bar.
- G. TMGB: Telecommunications main grounding bus bar.

1.04 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 19-INCH EQUIPMENT RACKS

- A. Description: Two- post racks with threaded rails designed for mounting telecommunications equipment. Width is compatible with EIA/ECIA 310-E, 19-inch (482.6-mm) equipment mounting with an opening of 17.72-inches (450-mm) between rails.

SECTION 271116 - COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES (continued):

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. B-line; Eaton, Electrical Sector.
2. Chatsworth.
3. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.
4. Panduit Corp.
5. Tripp-Lite.

C. General Requirements:

1. Frames: Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Material: Extruded steel.
3. Finish: Manufacturer's standard, baked-polyester powder coat.
4. Color: Black.

D. Wall-Mounted Racks:

1. Height: As indicated on Drawings.
2. Depth: **23 inches** (584.2 mm).
3. Load Rating: **150 lb** (65 kg).
4. Number of Rack Units per Rack: As indicated on Drawings.
5. Threads: Universal square.
6. Wall Attachment: Four mounting holes.
7. Equipment Access: Integral swing.

E. Cable Management:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.02 POWER STRIPS

A. Power Strips: Comply with UL 1363.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Rack mounting.
3. LED indicator lights for power and protection status.
4. LED indicator lights for reverse polarity and open outlet ground.
5. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
6. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
7. Cord connected with **15-foot** (4.5-m) line cord.
8. Rocker-type on-off switch, illuminated when in on position.
9. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
10. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three modes shall be not more than 330 V.

SECTION 271116 - COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES (continued):

2.03 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Rack and Cabinet TGBs: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with TIA-606-B. Predrilling shall be with holes for use with lugs specified in this Section.
 - 1. Cabinet-Mounted TGB: Terminal block, with stainless-steel or copper-plated hardware for attachment to cabinet.
 - 2. Rack-Mounted Horizontal TGB: Designed for mounting in 19- or 23-inch (482.6- or 584.2-mm) equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
 - 3. Rack-Mounted Vertical TGB: 72 or 36 inches (1828.8 or 914.4 mm) long, with stainless-steel or copper-plated hardware for attachment to rack.

2.04 LABELING

- A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout of communications equipment spaces.
- C. Comply with BICSI ITSIMM for installation of communications equipment spaces.
- D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- E. Coordinate layout and installation of communications equipment in racks and room. Coordinate service entrance configuration with service provider.
 - 1. Meet jointly with system providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
 - 2. Record agreements reached in meetings and distribute them to other participants.
 - 3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment spaces to accommodate and optimize configuration and space requirements of telecommunications equipment.
 - 4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.
- F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

SECTION 271116 - COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES (continued):

3.02 GROUNDING

- A. Comply with NECA/BICSI 607.
- B. Install grounding according to BICSI ITSIMM, "Bonding, Grounding (Earthing) and Electrical Protection" Ch.
- C. Locate TGB to minimize length of bonding conductors. Fasten to wall, allowing at least 2 inches (50 mm) of clearance behind TGB. Connect TGB with a minimum No. 4 AWG grounding electrode conductor from TGB to suitable electrical building ground. Connect rack TGB to near TGB or the TMGB.
 - 1. Bond the shield of shielded cable to patch panel, and bond patch panel to TGB or TMGB.

3.03 IDENTIFICATION

- A. Coordinate system components, wiring, and cabling complying with TIA-606-B. Comply with requirements in Section 270553 "Identification for Electrical Systems."
- B. Comply with requirements in Division 09 for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 3 level of administration, including optional identification requirements of this standard.
- D. Labels shall be machine printed. Type shall be 1/4 inch (6 mm) in height.

END OF SECTION 271116

SECTION 271323 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Type OFNR optical fiber cable.
 - 2. Type OFNP optical fiber cable.
 - 3. Optical fiber cable connecting hardware, patch panels, and cross-connects.

1.02 DEFINITIONS

- A. Conductive Cable: Cable containing non-current-carrying electrically-conductive members such as metallic strength members and metallic vapor barriers.
- B. Cross-Connect: A facility enabling termination of cable elements and their interconnection or cross-connection.
- C. Type OFCP: Conductive cable for use in plenums, ducts, and other spaces used for environmental air.
- D. Type OFCR: Conductive cable for use as riser in vertical shafts or from floor to floor.
- E. Type OFNP: Nonconductive cable for use in plenums, ducts, and other spaces used for environmental air.
- F. Type OFNR: Nonconductive cable for use as riser in vertical shafts or from floor to floor.

1.03 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

1.04 ACTION SUBMITTALS

- A. Product Data:
 - 1. For each type of product.
- B. Shop Drawings:
 - 1. System Labeling Schedules:
 - a. Electronic copy of labeling schedules, in software and format selected by Owner.
 - 2. Cabling administration drawings and printouts.
 - 3. Wiring diagrams showing typical schematic arrangement, including the following:
 - a. Telecommunications rooms plans and elevations.

SECTION 271323 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING (continued):

- b. Telecommunications pathways.
 - c. Telecommunications system access points.
 - d. Telecommunications grounding system.
 - e. Cross-connects.
 - f. Patch panels.
 - g. Patch cords.
4. Cross-Connect and Patch-Panel Drawings: Detail mounting assemblies and show elevations and physical relationship between installed components.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For optical fiber cable, splices, and connectors.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet-work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.
- B. Test cables upon receipt at Project site.
- 1. Test optical fiber cable to determine continuity of strand end to end. Use optical fiber flashlight or optical loss test set.

PART 2 - PRODUCTS

2.01 TYPE OFNR OPTICAL FIBER CABLE

- A. Description: This category covers jacketed optical fiber cable for use as risers in vertical runs in shaft or between floors within buildings in accordance with Article 770 of NFPA 70 containing no electrically conductive materials.
- B. Performance Criteria:
- 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 2. Listing Criteria: UL CCN QAYK; including UL 1651.
 - 3. General Characteristics:
 - a. Performance: TIA-568.3.
 - b. Inside Plant Mechanical Properties: ICEA S-83-596.
 - c. Inside-Outside Plant Mechanical Properties: ICEA S-104-696.
 - d. Jacket:
 - 1) Cable cordage jacket, fiber, unit, and group color in accordance with TIA-598.
 - 2) Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inch (1 m).
- C. Type OFNR, Designation OS2, Inside-Outside Plant, Single-Mode Optical Fiber Cable:

SECTION 271323 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING (continued):

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. **Belden Inc.**
 - b. **Berk-Tek, a Leviton Company.**
 - c. **CommScope, Inc.**
 - d. **Corning Optical Communications; Corning Incorporated.**
 - e. **Superior Essex Inc.; subsidiary of LS Corp.**
2. Source Limitations: Obtain products from single manufacturer.
3. Additional Characteristics:
 - a. Construction: TIA-492CAAB; 9 µm core diameter, 125 µm cladding diameter, with low water peak.
 - b. Minimum Overfilled Modal Bandwidth-Length Product: 500 MHz-km at 850 nm wavelength; 500 MHz-km at 1300 nm wavelength.
4. Options:
 - a. Configuration:
 - 1) 6 to 12-fiber, single loose tube, optical fiber cable.
 - 2) 24 to 144-fiber, stranded loose tube, optical fiber cable.
 - b. Maximum Attenuation: 0.5 dB/km at 1310 nm wavelength; 0.5 dB/km at 1550 nm wavelength.
 - c. Jacket Color: Black.

2.02 TYPE OFNP OPTICAL FIBER CABLE

- A. Description: This category covers jacketed optical fiber cable for use in vertical runs in plenums, ducts, or other spaces used for environmental air within buildings in accordance with Article 770 of NFPA 70 containing no electrically conductive materials.
- B. Performance Criteria:
 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 2. Listing Criteria: UL CCN QAYK; including UL 1651.
 3. General Characteristics:
 - a. Performance: TIA-568.3.
 - b. Inside Plant Mechanical Properties: ICEA S-83-596.
 - c. Inside-Outside Plant Mechanical Properties: ICEA S-104-696.
 - d. Jacket:
 - 1) Cable cordage jacket, fiber, unit, and group color in accordance with TIA-598.
 - 2) Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inch (1 m).
- C. Type OFNP, Designation OS2, Inside-Outside Plant, Single-Mode Optical Fiber Cable:

SECTION 271323 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING (continued):

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. **Belden Inc.**
 - b. **Berk-Tek, a Leviton Company.**
 - c. **CommScope, Inc.**
 - d. **Corning Optical Communications; Corning Incorporated.**
 - e. **Superior Essex Inc.; subsidiary of LS Corp.**
2. Source Limitations: Obtain products from single manufacturer.
3. Additional Characteristics:
 - a. Construction: TIA-492CAAB; 9 µm core diameter, 125 µm cladding diameter, with low water peak.
 - b. Minimum Overfilled Modal Bandwidth-Length Product: 500 MHz-km at 850 nm wavelength; 500 MHz-km at 1300 nm wavelength.
4. Options:
 - a. Configuration:
 - 1) 6 to 12-fiber, single loose tube, optical fiber cable.
 - 2) 24 to 144-fiber, stranded loose tube, optical fiber cable.
 - b. Maximum Attenuation: 0.5 dB/km at 1310 nm wavelength; 0.5 dB/km at 1550 nm wavelength.
 - c. Jacket Color: Black.

2.03 OPTICAL FIBER CABLE HARDWARE

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 1. **Belden Inc.**
 2. **Berk-Tek, a Leviton Company.**
 3. **CommScope, Inc.**
 4. **Corning Optical Communications; Corning Incorporated.**
 5. **Superior Essex Inc.; subsidiary of LS Corp.**
- B. Performance Criteria:
 1. Fiber Optic Connector Intermateability Standard (FOCIS) specifications of TIA-604 series.
 2. TIA-568.3.
- C. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
 1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.
- D. Patch Cords: Factory-made, dual-fiber cables in **36 inch (900 mm)** lengths.
- E. Connector Type: Type LC complying with TIA-604-10, connectors.
- F. Plugs and Plug Assemblies:

SECTION 271323 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING (continued):

1. Male; color-coded modular telecommunications connector designed for termination of single optical fiber cable.
2. Insertion loss not more than 0.25 dB.
3. Marked to indicate transmission performance.

G. Jacks and Jack Assemblies:

1. Female; quick-connect, simplex and duplex; fixed telecommunications connector designed for termination of single optical fiber cable.
2. Insertion loss not more than 0.25 dB.
3. Marked to indicate transmission performance.
4. Designed to snap-in to patch panel or faceplate.

2.04 SOURCE QUALITY CONTROL

A. Testing Administrator: Engage qualified testing agency to evaluate cables.

B. Tests and Inspections:

1. Test and inspect multimode optical fiber cables, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having jurisdiction, in accordance with TIA-526-14 and TIA-568.3 before delivering to site. Affix label with name and date of qualified electrical testing laboratory's certification of system compliance.
2. Test and inspect pre-terminated optical fiber cable assemblies, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having jurisdiction, in accordance with TIA-526-14 and TIA-568.3 before delivering to site. Affix label with name and date of qualified electrical testing laboratory's certification of system compliance.

C. Nonconforming Work:

1. Cables that do not pass tests and inspections will be considered defective.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Coordinate backbone cabling with protectors and demarcation point provided by communications service provider.

3.02 SELECTION OF OPTICAL FIBER TYPE

A. Installed in Vertical Shaft or Floor-to-Floor Riser:

1. Nonconductive:
 - a. Type OFNP in metallic conduit.

B. Installed in Plenum, Duct, or Other Space Handling Environmental Air:

SECTION 271323 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING (continued):

1. Nonconductive:
 - a. Type OFNP in metallic conduit.
- C. Installed in Location Other Than Riser or Plenum:
 1. Nonconductive: Type OFNP in metallic conduit.

3.03 INSTALLATION OF OPTICAL FIBER BACKBONE CABLES

- A. Optical fiber backbone cabling system must provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
- B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters may not be used as part of backbone cabling.
- C. Comply with BICSI N1, NECA NEIS 1, and NECA NEIS 301.
- D. Backbone cabling system must comply with transmission standards in TIA-568.1.
- E. Telecommunications Pathways and Spaces: Comply with TIA-569.
- F. Wiring Methods:
 1. In Raceway: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
 - a. Install plenum cable in environmental airspaces, including plenum ceilings.
 - b. Comply with requirements for pathways specified in Section 270528 "Pathways for Communications Systems."
 2. In Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- G. Optical Fiber Cabling Installation:
 1. Comply with TIA-568.1 and TIA-568.3.
 2. Comply with BICSI ITSIMM, Ch. 6, "Cable Termination Practices."
 3. Terminate all cables; no cable may contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inch (760 mm) and not more than 6 inch (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 6. Bundle, lace, and train cable to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
 7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

SECTION 271323 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING (continued):

8. In communications equipment room, provide 10 ft (3 m) long service loop on each end of cable.
9. Pulling Cable: Comply with BICSI ITSIMM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
10. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

H. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Cable may not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

I. Group connecting hardware for cables into separate logical fields.

3.04 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569, Annex A, "Firestopping."
- C. Comply with BICSI ITSIMM, "Firestopping" Chapter.

3.05 GROUNDING

- A. Install grounding in accordance with BICSI ITSIMM, "Grounding (Earthing), Bonding, and Electrical Protection" Chapter.
- B. Comply with TIA-607 and NECA/BICSI-607.
- C. Locate grounding bus bar to minimize length of bonding conductors. Fasten to wall allowing at least 2 inch (50 mm) clearance behind grounding bus bar. Connect grounding bus bar with minimum 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to grounding bus bar, using not smaller than 6 AWG equipment grounding conductor.

3.06 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
 1. Administration Class: Class 3.
 2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Paint and label colors for equipment identification must comply with TIA-606 for Class 3 level of administration including optional identification requirements of this standard.
- C. Cable Schedule: Install in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish electronic copy of final comprehensive schedules for Project.

SECTION 271323 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING (continued):

- D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- E. Cable and Wire Identification:
 - 1. Label each cable within **4 inch (100 mm)** of each termination and tap, where it is accessible in cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
 - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding **15 ft (4.5 m)**.
 - 4. Label each unit and field within distribution racks and frames.
 - 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use different color for jacks and plugs of each service.
- F. Labels must be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA 606, for the following:
 - 1. Flexible vinyl or polyester that flexes as cables are bent.

3.07 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Visually inspect optical fiber jacket materials for qualified electrical testing laboratory certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568.1.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 3. Optical Fiber Cable Tests:
 - a. Test instruments must meet or exceed applicable requirements in TIA-568.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Link End-to-End Attenuation Tests:
 - 1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in one direction in accordance with TIA-526-14, Method B, One Reference Jumper.
 - 2) Attenuation test results for backbone links must be less than 2.0 dB. Attenuation test results must be less than those calculated in accordance with equation in TIA-568.1.
- B. Nonconforming Work:
 - 1. Cables will be considered defective if they do not pass tests and inspections.
 - 2. Remove and replace defective cables and retest.
- C. Collect, assemble, and submit test and inspection reports.
 - 1. Data for each measurement must be documented.

SECTION 271323 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING (continued):

2. Data for field quality-control report submittals must be printed in summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from instrument to computer, saved as text files, and printed and submitted.
- D. Manufacturer Services:
1. Engage factory-authorized service representative to support field tests and inspections.

END OF SECTION 271323

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SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Category 6 twisted pair cable.
2. Category 6a twisted pair cable.
3. Twisted pair cable hardware, including plugs and jacks.
4. Cabling identification products.
5. Grounding provisions for twisted pair cable.
6. Source quality control requirements for twisted pair cable.

1.02 DEFINITIONS

- A. Cross-Connect:** A facility enabling the termination of cable elements and their interconnection or cross-connection.
- B. EMI:** Electromagnetic interference.
- C. FTP:** Shielded twisted pair.
- D. F/FTP:** Overall foil screened cable with foil screened twisted pair.
- E. F/UTP:** Overall foil screened cable with unscreened twisted pair.
- F. IDC:** Insulation displacement connector.
- G. LAN:** Local area network.
- H. Jack:** Also commonly called an "outlet," it is the fixed, female connector.
- I. Plug:** Also commonly called a "connector," it is the removable, male telecommunications connector.
- J. RCDD:** Registered Communications Distribution Designer.
- K. Screen:** A metallic layer, either a foil or braid, placed around a pair or group of conductors.
- L. Shield:** A metallic layer, either a foil or braid, placed around a pair or group of conductors.
- M. S/FTP:** Overall braid screened cable with foil screened twisted pair.
- N. S/UTP:** Overall braid screened cable with unscreened twisted pairs.
- O. UTP:** Unscreened (unshielded) twisted pair.

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING (continued):

1.03 COPPER HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.
 - 1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
 - 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
 - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the equipment outlets to the station equipment.
- C. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Reviewed and stamped by RCDD.
 - 1. System Labeling Schedules:
 - a. Electronic copy of labeling schedules, in software and format selected by Owner.
 - 2. Cabling administration Drawings and printouts.
 - 3. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment, including the following:
 - a. Telecommunications rooms plans and elevations.
 - b. Telecommunications pathways.
 - c. Telecommunications system access points.
 - d. Telecommunications grounding system.
 - e. Telecommunications conductor drop locations.
 - f. Typical telecommunications details.
 - g. Mechanical, electrical, and plumbing systems.
- C. Twisted pair cable testing plan.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING (continued):

1. Layout Responsibility: Preparation of Shop Drawings, cabling administration Drawings, and field testing program development by an RCDD.
 2. Installation Supervision: Installation shall be under the direct supervision of Technician, who shall be present at all times when Work of this Section is performed at Project site.
 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- B. Testing Agency Qualifications: Testing agency must have personnel certified by BICSI on staff.
1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD.
- 1.07 **DELIVERY, STORAGE, AND HANDLING**
- A. Test cables upon receipt at Project site.
1. Test each pair of twisted pair cable for open and short circuits.
- 1.08 **PROJECT CONDITIONS**
- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- 1.09 **COORDINATION**
- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

- 2.01 **PERFORMANCE REQUIREMENTS**
- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.
- B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.
- C. Grounding: Comply with TIA-607-B.
- 2.02 **GENERAL CABLE CHARACTERISTICS**
- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
1. Communications, Plenum Rated:
 - a. Type CMP complying with UL 1685.
 2. Communications, Non-Plenum Rated:

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING (continued):

- a. Type CMR complying with UL 1666.
- B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.
- C. RoHS compliant.

2.03 CATEGORY 6 TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250 MHz.
- B. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1. [Belden Inc.](#)
 - 2. [Berk-Tek, a Leviton Company.](#)
 - 3. [CommScope, Inc.](#)
 - 4. [Superior Essex Inc.; subsidiary of LS Corp.](#)
- C. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.
- D. Conductors: 100-ohm, 23 AWG solid copper.
- E. Shielding/Screening: As indicated on plans.
- F. Cable Rating: Plenum.
- G. Jacket: Thermoplastic.

2.04 CATEGORY 6a TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500 MHz.
- B. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1. [Belden Inc.](#)
 - 2. [Berk-Tek, a Leviton Company.](#)
 - 3. [CommScope, Inc.](#)
 - 4. [Superior Essex Inc.; subsidiary of LS Corp.](#)
- C. Standard: Comply with TIA-568-C.2 for Category 6a cables.
- D. Conductors: 100-ohm, 23 AWG solid copper.
- E. Shielding/Screening: As indicated on plans.
- F. Cable Rating: Plenum.
- G. Jacket: Thermoplastic.

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING (continued):

2.05 TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Belden Inc.
 - 2. Berk-Tek, a Leviton Company.
 - 3. CommScope, Inc.
 - 4. Superior Essex Inc.; subsidiary of LS Corp.
- C. General Requirements for Twisted Pair Cable Hardware:
 - 1. Comply with the performance requirements of Category 6 or Category 6a.
 - 2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
 - 3. Cables shall be terminated with connecting hardware of same category or higher.
- D. Source Limitations: Obtain twisted pair cable hardware from same manufacturer as twisted pair cable, from single source.
- E. Connecting Blocks:
 - 1. 110-style IDC for Category 6.
 - 2. 110-style IDC for Category 6a.
 - 3. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.
- F. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.
 - 1. Features:
 - a. Universal T568A and T568B wiring labels.
 - b. Labeling areas adjacent to conductors.
 - c. Replaceable connectors.
 - d. 24 or 48 ports.
 - 2. Construction: 16-gauge steel and mountable on 19-inch (483 mm) equipment racks.
 - 3. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.
- G. Patch Cords: Factory-made, four-pair cables in 36-inch (900-mm) lengths; terminated with an eight-position modular plug at each end.
 - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
- H. Plugs and Plug Assemblies:
 - 1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
 - 2. Standard: Comply with TIA-568-C.2.
 - 3. Marked to indicate transmission performance.

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING (continued):

I. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Designed to snap-in to a patch panel or cover plate.
3. Standard: Comply with TIA-568-C.2.
4. Marked to indicate transmission performance.

J. Cover Plate:

1. Four port, vertical single gang cover plates designed to mount to single gang wall boxes.
2. Metal Cover Plate: Stainless steel, complying with requirements in Section 260533 "Raceway and Boxes for Electrical Systems."
3. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.
 - a. Flush mounting jacks, positioning the cord at a 45-degree angle.

K. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

2.06 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.07 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test cables on reels according to TIA-568-C.1.
- C. Factory test twisted pair cables according to TIA-568-C.2.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 WIRING METHODS

A. Routing:

1. Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, attics, and gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables, except in unfinished spaces.
 - a. Install plenum cable in environmental air spaces, including plenum ceilings.

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING (continued):

- b. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems."
 - 2. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
 - B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.
- 3.02 **INSTALLATION OF PATHWAYS**
- A. Comply with requirements for demarcation point, cabinets, and racks specified in Section 271100 "Communications Equipment Room Fittings."
 - B. Comply with Section 270528 "Pathways for Communications Systems."
 - C. Comply with Section 270529 "Hangers and Supports for Communications Systems."
 - D. Comply with Section 270536 "Cable Trays for Communications Systems."
 - E. Drawings indicate general arrangement of pathways and fittings.
- 3.03 **INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES**
- A. Comply with NECA 1 and NECA/BICSI 568.
 - B. General Requirements for Cabling:
 - 1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.
 - 2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. Do not untwist twisted pair cables more than **1/2 inch (12 mm)** from the point of termination to maintain cable geometry.
 - 5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - 6. MUTOA shall not be used as a cross-connect point.
 - 7. Consolidation points may be used only for making a direct connection to equipment outlets:
 - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
 - b. Locate consolidation points for twisted-pair cables at least **49 feet (15 m)** from communications equipment room.
 - 8. Cables may not be spliced. Secure and support cables at intervals not exceeding **30 inches (760 mm)** and not more than **6 inches (150 mm)** from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 9. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
 - 10. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING (continued):

Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.

11. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.
12. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
13. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 48 inches (1219 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Group connecting hardware for cables into separate logical fields.

E. Separation from EMI Sources:

1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING (continued):

3.04 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with "Firestopping Systems" Article in BICSI's "Telecommunications Distribution Methods Manual."

3.05 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."
- C. Comply with TIA-607-B and NECA/BICSI-607.
- D. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.
- E. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.06 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
 - 1. Administration Class: Class 3.
 - 2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 3 level of administration, including optional identification requirements of this standard.
- C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- E. Cable and Wire Identification:
 - 1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING (continued):

3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding **15 feet (4.5 m)**.
 4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
 - b. Label each unit and field within distribution racks and frames.
 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- F. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:
1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.07 FIELD QUALITY CONTROL

- A. Tests and Inspections:
1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- B. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.
- C. Nonconforming Work:
1. End-to-end cabling will be considered defective if it does not pass tests and inspections.
 2. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- D. Collect, assemble, and submit test and inspection reports.
- E. Manufacturer Services:
1. Engage factory-authorized service representative to support field tests and inspections.

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING (continued):

END OF SECTION 271513

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SECTION 280100 - GENERAL PROVISIONS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Provisions of this Section apply to all Division 28 Specification Sections.

1.02 SUMMARY

- A. Section includes basic requirements for electronic safety and security systems.
- B. Related Work:
 - 1. Division 03 – Concrete
 - a. Refer to Division 03 for rough grouting in and around work, patching concrete cut to accommodate work, and sumps for work.
 - b. Comply with the requirements of Division 03 for curbs, foundations, and equipment pads for equipment.
 - 2. Division 05 – Metals
 - a. Refer to Division 05 for framed openings for equipment.
 - b. Comply with the requirements of Division 05 for supports for work.
 - 3. Division 06 – Wood, Plastics, and Composites
 - a. Refer to Division 06 for framed openings for equipment.
 - 4. Division 07 – Thermal and Moisture Protection
 - a. Refer to Division 07 for installation of roof curbs and roof supports and for caulking and waterproofing of wall- and roof-mounted work.
 - b. Comply with the requirements of Division 07 for penetration firestopping and furnishing roof curbs and roof supports for equipment and conduit.
 - 5. Division 08 – Openings
 - a. Refer to Division 08 for installation of access doors and frames.
 - b. Comply with the requirements of Division 08 for access doors and frames, unless otherwise included in the Contract Documents.
 - 6. Division 09 – Finishes
 - a. Refer to Division 09 for paint products and applications in finished spaces.
 - b. Comply with the requirements of Division 09 for paint products and applications identified in the Contract Documents.
 - 7. Division 10 – Specialties
 - a. Refer to Division 10 for fire protection cabinets and fire extinguishers.
 - 8. Division 21 – Fire Suppression
 - a. Refer to Division 21 for all suppression work.

SECTION 280100 - GENERAL PROVISIONS FOR ELECTRONIC SAFETY AND SECURITY
(continued):

9. Division 22 – Plumbing
 - a. Refer to Division 22 for all plumbing work.
10. Division 23 – Heating, Ventilation, and Air-Conditioning
 - a. Refer to Division 23 for all heating, ventilation, and air-conditioning work.
11. Division 25 – Instrumentation and Control
 - a. Refer to Division 25 for instrumentation and control systems.
 - b. Comply with the requirements of Division 25 for installation of and integration with instrumentation and control components.
12. Division 26 – Electrical
 - a. Refer to Division 26 for all electrical work.
13. Division 27 – Communications
 - a. Refer to Division 27 for all communications work.
 - b. Coordinate with Division 27 for integration with communication systems.
14. Division 29 – Fire Safety and Emergency Communications
 - a. Refer to Division 29 for all fire safety and emergency communications work.
 - b. Coordinate with Division 29 for integration with fire safety and emergency communications systems.
15. Division 31 – Earthwork
 - a. Refer to Division 31 for all site related work greater than five feet outside the building, unless noted otherwise in the Contract Documents.
 - b. Comply with the requirements of Division 31 for site clearing, earth moving, and dewatering within five feet outside the building and otherwise as indicated in the Contract Documents.
16. Division 33 – Utilities
 - a. Refer to Division 33 for all utility related work greater than five feet outside the building, unless noted otherwise in the Contract Documents.
 - b. Comply with the requirements of Division 33 for utility work within five feet outside the building and otherwise as indicated in the Contract Documents.

1.03 **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. Furnish: Supply and deliver to project site, ready for subsequent requirements.
- C. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.
- D. Provide: Furnish and install, complete and ready for intended use.
- E. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

SECTION 280100 - GENERAL PROVISIONS FOR ELECTRONIC SAFETY AND SECURITY
(continued):

- F. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.
- G. Concealed Work: Work hidden from view, including inside chases, furred spaces, or above ceilings.
- H. Exposed Work: Work open to view, including inside mechanical and equipment rooms and on mezzanines.

1.04 QUALITY ASSURANCE

- A. General:
 - 1. It is the intent of the plans and specifications to obtain a complete, operable and satisfactory installation.
 - 2. All materials shall be new, be properly labeled and/or identified and be in full compliance with the contract documents.
 - 3. All work shall comply with applicable Codes and Standards.
 - 4. Manufacturer's model names and numbers used in these specifications are subject to change per manufacturer's action. Contractor shall therefore verify them with manufacturer's representative before ordering any product or equipment
- B. Furnish new and unused materials and equipment manufactured in the U.S.A. Where two or more units of the same type or class of equipment are required provide units of a single manufacturer.

1.05 CODES AND STANDARDS

- A. Perform work in accordance with the following codes and any applicable statutes, ordinances, codes, and regulations of governmental authorities having jurisdiction.
 - 1. Occupational Safety and Health Regulations (OSHA).
 - 2. National Fire Codes
 - a. NFPA 1 Uniform Fire Code – 2021 (Florida Edition)
 - b. NFPA 70 National Electrical Code – 2020
 - c. NFPA 72 National Fire Alarm and Signaling Code - 2019
 - d. NFPA 75 Standard for the Fire Protection of Information Technology Equipment – 2020
 - e. NFPA 76 Standard for the Fire Protection of Telecommunications Facilities – 2020
 - f. NFPA 101 Life Safety Code – 2021 (Florida Edition)
 - 3. Florida Building Code, 2023 Edition
 - a. Building Code
 - b. Existing Building Code
 - c. Energy Conservation Code
 - d. Mechanical Code
 - e. Plumbing Code
 - f. Fuel Gas Code
 - g. Accessibility Code
 - 4. Florida Statutes
 - a. Chapter 471 Engineering

SECTION 280100 - GENERAL PROVISIONS FOR ELECTRONIC SAFETY AND SECURITY
(continued):

- b. Chapter 533.80 Building Construction Standards; Florida Building Code - Enforcement
- 5. Florida Administrative Code
 - a. Chapter 9B-7 Florida Building Commission Handicapped Accessibility Standards
 - b. Chapter 61G15-32 Responsibility Rules of Professional Engineers Concerning the Design of Fire Protection Systems
 - c. Chapter 61G15-33 Responsibility Rules of Professional Engineers Concerning the Design of Electrical Systems
 - d. Chapter 69A-3 Fire Prevention – General Provisions
 - e. Chapter 69A-60 The Florida Fire Prevention Code
- B. Resolve, in writing, any code violation discovered in contract documents with the Engineer prior to bidding. After award of the contract, make any correction or addition necessary for compliance with applicable codes at no additional cost to Owner.
- C. The Contractor shall include in the Work, without extra cost to the Owner, any labor, materials, services, apparatus, and drawings required to comply with all applicable laws, ordinances, rules, and regulations.
- D. Where there is conflict between the Contract Documents and the applicable Codes, the Codes shall govern, except where the requirements of the Contract Documents are more stringent.

1.06 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or NEC Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments, or supplements in effect on date bids are received. Specifications and standards are minimum requirements for all equipment, material and work. In instances where capacities, size or other feature of equipment, devices or materials exceed these minimums, meet listed or shown capacities.
- B. Whenever a reference is made to a standard, installation and materials shall comply with the latest published edition of the standard at the time project is bid unless otherwise specified herein

1.07 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.

1.08 PERMITS FEES AND INSPECTIONS

- A. Obtain and pay for all permits, fees, tap fees, connection charges, demand charges, systems charges, impact fees, and inspections.
- B. Deliver all certificates of inspection issued by authorities having jurisdiction to the Engineer.

1.09 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer

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conflicting requirements that are different, but apparently equal, to Engineer for direction before proceeding.

1. If discrepancies or conflicts occur between drawings, or between drawings and specifications, notify the Engineer in writing prior to bid date; however, the most stringent requirement shall govern.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.10 SUBMITTALS

- A. Submittals (including Product Data, Shop Drawings, and any other Action Submittal or Information Submittal) will only be reviewed if they are submitted in full accordance with the General and Supplementary Conditions, Division 01, and the following:
 1. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are approved by the Engineer.
 3. Submittals shall only contain relevant product data. Remove or strikeout irrelevant product data.
 4. Prepare submittals as PDF electronic files and electronically transmit to Engineer through email or web-based project software site, in accordance with Division 01 Specification Sections. Submittals shall be in searchable PDF format and not a scanned copy.
 5. Options: Identify options requiring selection by Engineer.
 6. Deviations: Clearly identify deviations from requirements in the Contract Documents, including minor variations and limitations.
 7. Revisions: Include relevant additional information and revisions, other than those specifically requested by Engineer on previous submittals. Indicate by highlighting on each submittal or noting on attached submittal sheet.
 8. Contractor's Review:
 - a. Submittals shall have been reviewed and approved by the General Contractor / Construction Manager. Include approval stamp, 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.
 - b. Engineer will not review submittals received from Contractor that do not have Contractor's review and approval.
 9. Electrical Modifications:
 - a. The electrical design indicated on the plans supports the Basis of Design specifications for the Electronic Safety and Security systems at the time of design.
 - b. If Electronic Safety and Security systems equipment is submitted with different electrical requirements, it is the responsibility of the Contractor to resolve all required electrical design changes, including, but not limited to: wire and conduit size, type or size of disconnect or overload protection, breaker coordination, point(s) of connection, etc. Any corrections required shall be provided at no additional cost.
 - c. Submittal shall clearly show the electrical design revisions with a written statement that this change will be provided at no additional cost. Submittals made with no written

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reference to the electrical design revisions will be presumed to work with the electrical design.

- B. Processing Time: Allow 15 days for submittal review. Time of review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of the failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. The Contractor shall not be relieved of responsibility for deviations from requirements of the contract documents by the Engineer's approval of shop drawings, product data, samples, or similar submittals unless the Contractor has specifically informed the Engineer in writing of such deviation at the time of submittal, and the Engineer has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in shop drawings, product data, samples, or similar submittals by the Engineer's approval thereof.
- D. Submittals on any particular phase of Work will receive only one review and one re-review (if required). If additional reviews are required beyond these two, the Contractor will be charged \$120.00 per hour for review time. This fee shall be paid to the Engineer prior to Submittal release.

1.11 SUBSTITUTIONS

- A. By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.
- B. Substitution Requests shall include, at a minimum:
 - 1. Statement indicating why specified material, equipment, or installation method cannot be provided, if applicable.
 - 2. Coordination of information, including a list of changes and 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.
 - 3. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include an 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.
 - 4. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - 5. 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.
 - 6. Cost information, including a proposal of change, if any, in the Contract Sum.
 - 7. 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.

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8. 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.
- C. Procurement Substitution Requests submitted prior to receipt of bids will be received and considered by Owner when the following conditions are satisfied, as determined by Engineer; otherwise, requests will be returned without action:
1. Requests for substitution of materials and equipment are received no later than 10 days prior to date of bid opening.
 2. Extensive revisions to the Contract Documents are not required.
 3. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.
 4. The request is fully documented and properly submitted.
- D. Substitutions for Cause, as required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms will be received and considered by Engineer, only when the following conditions are satisfied; otherwise, requests will be returned without action, except to record noncompliance with these requirements:
1. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 2. Substitution request is fully documented and properly submitted.
 3. Requested substitution has received necessary approvals of authorities having jurisdiction.
 4. Requested substitution is compatible with other portions of the Work.
 5. Requested substitution has been coordinated with other portions of the Work.
 6. Requested substitution provides specified warranty.
 7. 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.
- E. Substitutions for Convenience, not required in order to meet other Project requirements but may offer advantage to Contractor or Owner, will be received and considered by Owner, as determined by Engineer, only when the following conditions are satisfied; otherwise, requests will be returned without action, except to record noncompliance with these requirements:
1. Requested substitution is received within 60 days after the Notice of Award.
 2. 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 Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 3. Requested substitution does not require extensive revisions to the Contract Documents.
 4. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 5. Substitution request is fully documented and properly submitted.
 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 7. Requested substitution is compatible with other portions of the Work.
 8. Requested substitution has been coordinated with other portions of the Work.
 9. Requested substitution provides specified warranty.
 10. 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.
- F. If a requested substitution is approved but contains differences or omissions not specifically identified to the attention of the Engineer in the substitution request, the Owner reserves the right to require equal or similar features to be added to the substituted products or to have the substituted products replaced at the Contractor's expense.

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1.12 PROJECT RECORD DOCUMENTS

- A. Recording: Maintain one copy of the Contract Documents and Shop Drawings during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Preparation:
 - 1. Contract Drawings and Shop Drawings:
 - a. Mark revisions to show where the actual installation varies from that shown originally.
 - b. Mark record sets completely and accurately, including important information that was either shown schematically or omitted from original Drawings.
 - c. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - d. Record underground and under-slab piping installed, dimensioning exact location and elevation of piping.
 - 2. Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 3. Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
- C. Deliver: Prior to Final Completion, provide record documents to Owner as indicated below:
 - 1. Record Drawings: Submit PDF electronic files of scanned record prints and one set of prints.
 - 2. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
 - 3. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
 - 4. Miscellaneous Record Submittals: Submit annotated PDF electronic files directories of each submittal.

1.13 OPERATION AND MAINTENANCE MANUALS

- A. Prepare and submit a comprehensive manual of emergency, operation, and maintenance data and materials in full accordance with the General and Supplementary Conditions, Division 01, and the following:
 - 1. Operations and Maintenance Manuals: Assemble a complete set of data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system, including:
 - a. Information required for daily operation and management, operating standards, and routine and special operating procedures.
 - b. Manufacturers' maintenance documentation, preventative maintenance procedures and frequency, repair procedures, wiring and systems diagrams, list of spare parts, and warranty information.
 - 2. Submit manuals as PDF electronic files and electronically transmit to Engineer through email or web-based project software site, in accordance with Division 01 Specification Sections. Submittals shall be in searchable PDF format and not a scanned copy.

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1.14 DEMONSTRATION AND TRAINING

- A. Prepare and provide services of qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not a part of a system in accordance with the General and Supplementary Conditions, Division 01, individual Specification Sections, and the following:
 - 1. Demonstration and training shall occur upon completion of the Work and at a time designated by the Owner's representative.
 - 2. Provide a high-resolution, digital video recording of each training session to the Owner.

1.15 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected in Division 01 "Product Requirements".

1.16 WARRANTY

- A. Warranty work and equipment within specified warranty period. During the warranty period, provide labor and materials to make good any faults or imperfections that may arise due to defects or omissions in materials or workmanship without expense to the Owner.
 - 1. Warranty Period: One year from date of Substantial Completion.
- B. 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 Contract Documents.
- C. Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond nor relieving the Contractor of responsibilities during the warranty period.

PART 2 - EXECUTION

2.01 CONTRACT DOCUMENTS

- A. Examine all drawings and specifications carefully before submitting a bid. Architectural drawings take precedence over mechanical or electrical drawings with reference to building construction.
- B. For purposes of clearness and legibility, drawings are essentially diagrammatic and, although size and location of equipment are drawn to scale wherever possible, Contractor shall make use of all data in all of the contract documents and shall verify this information at the building site.
- C. The drawings indicate required size and points of termination of pipes, conduits, and ducts and suggest proper routes to conform to structure avoid obstructions and preserve clearances. However, it is not intended that drawings indicate all necessary offsets, and it shall be the responsibility of the Contractor to make the installation in such a manner as to conform to structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further instructions or cost to the Owner.

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- D. Furnish, install and/or connect with appropriate services all items shown on any drawing without additional compensation.
- E. Any and all questions about a subcontractor's scope of work responsibility shall be addressed to and answered by the General Contractor / Construction Manager.
- F. Questions About Construction Documents: Any and all questions shall be submitted through the proper channels IN WRITING and, in turn, shall be answered by the Engineer in writing. All telephone conversations shall be considered unofficial and, as such, shall not be considered official or binding responses to Contractor's questions.
- G. Drawings, specifications, or other documents issued by the Engineer in electronic format and/or electronic media are provided for convenience only and are not intended for use as Contract Documents.
 - 1. The electronic files are provided merely as a convenience to the Recipient.
 - 2. The electronic files do not replace or supplement the paper copies of any drawings, specifications, or other documents included in the Contract Documents for use on the project.
 - 3. The Engineer makes no representation, warranty, or guarantee that electronic files:
 - a. Are suitable for any other usage or purpose.
 - b. Have any particular durability.
 - c. Will not damage or impair the Recipient's computer or software.
 - d. Contain no errors or mechanical flaws or other discrepancies that may render them unsuitable for the purpose intended by the Recipient.
 - 4. Due to the unsecured nature of the electronic files and the inability of Engineer or the Recipient to establish controls over their use, the Engineer assumes no responsibility for any consequences arising out of the use of the data. It is the sole responsibility of the Recipient to check the validity of all information contained therein. The Recipient shall at all times refer to the signed and sealed drawings, specification or other documents for the project during all phases of the project. The Recipient shall assume all risks and liabilities resulting from the use of the electronic files.

2.02 **SUPERVISION OF WORK**

- A. Perform all work under the direct supervision of an experienced, qualified superintendent. The Engineer has the right to remove a superintendent who, in the Engineer's opinion, is not satisfactory.

2.03 **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, mechanical and electrical systems, and other construction affecting the Work.
- 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.
 - 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.

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3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

2.04 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, 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 caused by differing field conditions outside the control of Contractor, submit a request for information to Engineer.
- E. Interruption of Service: Before any existing equipment or system is shut down for disconnecting or tie-ins, coordinate with Engineer and Owner regarding acceptable dates and times for this Work to be performed. Work shall be performed at the time best suited for the Owner, which typically is either on weekends, holidays, and/or after normal working hours. Services shall be restored the same day unless prior arrangements are made. All overtime or premium costs associated with this Work shall be included in the Contractor's bid.

2.05 INSTALLATION

- A. Install materials and equipment in a professional manner. The Engineer may direct replacement of items which, in the Engineer's opinion, do not present a professional appearance or do not allow adequate space for maintenance. Replace or reinstall items at the expense of the Contractor.
- B. General: 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 (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.
- C. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- D. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

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- E. 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.
- F. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- G. Obstructions
 - 1. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
 - 2. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided. Verify locations given.
 - 3. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
 - 4. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.
- H. Where "rated" walls, floor, roofs and ceilings are penetrated or cut to install equipment, materials, devices, etc. the Contractor shall provide and install all materials required to re-establish the rating of the wall, floor, roof, or ceiling to the satisfaction of the authority having jurisdiction.
- I. Structural Elements: Do not cut structural elements without written approval from Engineer. Notify Engineer of locations and details of cutting and await directions from Engineer before proceeding. If approved by Engineer:
 - 1. Shore, brace, and support structural elements during cutting and patching.
 - 2. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
- J. Space Requirements: Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material which is not suitable in this respect.
- K. Tools and Equipment: Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions without cost to the Owner.
- L. Phasing: Provide all temporary valves, piping, ductwork, equipment, and devices as required. Maintain temporary services to areas as required. Remove all temporary material and equipment on completion of work unless Engineer concurs that such material and equipment would be beneficial to the Owner on a permanent basis.

2.06 OWNER-INSTALLED PRODUCTS

- A. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

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(continued):

2.07 UTILITY SERVICES AND ELECTRONIC SAFETY AND SECURITY SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

2.08 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Structural Elements: When cutting and patching structural elements, notify Engineer of locations and details of cutting and await directions from Engineer before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
- F. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
- G. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety.
- H. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- I. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.

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5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.
- J. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable or with in-place materials.
 1. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 2. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials.
- K. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

2.09 **PAINTING**

- A. Comply with requirements with General and Supplementary Conditions, Division 01, Division 09, and individual Specification Sections.
- B. Touch-up factory finishes on equipment provided under Division 28. Obtain matched color coatings from the manufacturer and apply as directed. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint, as required.
- C. Paint the following work where exposed to view:
 1. Metal conduit
 2. Plastic conduit
- D. Paint the following work where exposed in occupied spaces:
 1. Other items as directed by Engineer.

2.10 **REPAIR OF WORK**

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 1. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

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2. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

2.11 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Tests
 1. Include all tests specified and/or required under laws, rules and regulations of all departments having jurisdiction. Tests shall also be performed as indicated herein and other sections of the specifications.
 2. After all systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation. Make adjustments as required to ensure proper functioning of all systems.
 3. All parts of the work and associated equipment shall be tested and adjusted to work properly and be left in perfect operating condition.
 4. Correct defects disclosed by these tests without any additional cost to the Owner. Repeat tests on repaired or replaced work.
 5. Maintain a log of all tests being conducted and have it available for review by the Engineer. Log to indicate date, type of tests, duration, and defects noted and when corrected.
 6. Special tests on individual systems are specified under individual Specification Sections.
- 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.

2.12 CLEANING

- A. Progress Cleaning: 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 (27 deg C).
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Final 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. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - b. Remove labels that are not permanent.
 - c. Wipe surfaces of equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

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2.13 MAINTENANCE SERVICE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of systems and equipment Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacture's authorized replacement parts and supplies.

END OF SECTION 280100

SECTION 280523 - CONTROL-VOLTAGE CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Category 6 balanced twisted pair cable.
 - 2. Balanced twisted pair cable hardware.
 - 3. Control cable.
 - 4. Control-circuit conductors.

1.02 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.
 - 1. Flame Travel Distance: 60 inch (1520 mm) or less.
 - 2. Peak Optical Smoke Density: 0.5 or less.
 - 3. Average Optical Smoke Density: 0.15 or less.
- C. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
- D. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

2.02 CATEGORY 6 BALANCED TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250 MHz.
- B. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.
- C. Conductors: 100 ohm, No. 23 AWG solid copper.
- D. Shielding/Screening: Shielded twisted pairs (FTP).

SECTION 280523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES (continued):

- E. Cable Rating: Plenum.
- F. Jacket: Yellow thermoplastic.

2.03 BALANCED TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate balanced twisted pair copper communications cable.
- B. General Requirements for Balanced Twisted Pair Cable Hardware:
 - 1. Comply with the performance requirements of Category 6.
 - 2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
 - 3. Cables must be terminated with connecting hardware of same category or higher.
- C. Source Limitations: Obtain balanced twisted pair cable hardware from single source from single manufacturer.
- D. Plugs and Plug Assemblies:
 - 1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair 100 ohm unshielded or shielded balanced twisted pair cable.
 - 2. Comply with IEC 60603-7-1, IEC 60603-7-2, IEC 60603-7-3, IEC 60603-7-4, and IEC 60603-7.5.

2.04 CONTROL CABLE

- A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 - 1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
 - 2. PVC insulation.
 - 3. Unshielded.
 - 4. PVC jacket.
 - 5. Flame Resistance: Comply with NFPA 262.

2.05 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- B. Class 2 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- D. Class 2 Control Circuits and Class 3 Remote-Control and Signal Circuits That Supply Critical Circuits: Circuit Integrity (CI) cable.
 - 1. Smoke control signaling and control circuits.
 - 2. Critical operations power system (COPS).

SECTION 280523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES (continued):

2.06 FIRE-ALARM WIRE AND CABLE

- A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- B. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG in pathway.
 - 1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.
- C. Non-Power-Limited Circuits: Solid-copper conductors with 600 V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.
 - 1. Control-Voltage Circuits: No. 16 AWG, minimum, in pathway.
 - 2. Low-Voltage Circuits: No. 12 AWG, minimum, in pathway.
 - 3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NRTL listed for fire-alarm and cable tray installation, plenum rated.

PART 3 - EXECUTION

3.01 INSTALLATION OF RACEWAYS AND BOXES

- A. Comply with requirements in Section 280533 “Raceways and Boxes for Electronic Safety and Security” for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.
 - 1. Outlet boxes for cables must be no smaller than 4 inch (102 mm) square by 2-1/8 inch (53 mm) deep with extension ring sized to bring edge of ring to within 1/8 inch (3.1 mm) of the finished wall surface.
 - 2. Flexible metal conduit must not be used.
- B. Install manufactured conduit sweeps and long-radius elbows if possible.
- C. Raceway Installation in Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
 - 2. Secure conduits to backboard if entering the room from overhead.
 - 3. Extend conduits 3 inch (75 mm) above finished floor.
 - 4. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.02 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:

SECTION 280523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES (continued):

1. Terminate all conductors; cable must not contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 2. Cables may not be spliced and must be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.
 3. Cables serving a common system may be grouped in a common raceway. Install network cabling and control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
 4. Secure and support cables at intervals not exceeding **30 inch (760 mm)** and not more than **6 inch (150 mm)** from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 5. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
 6. Keep runs short. Allow extra length for connecting to terminals. Do not bend cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
 7. Ground wire must be copper, and grounding methods must comply with IEEE C2. Demonstrate ground resistance.
- C. Balanced Twisted Pair Cable Installation:
1. Comply with TIA-568-C.2.
 2. Do not untwist balanced twisted pair cables more than **1/2 inch (12 mm)** at the point of termination to maintain cable geometry.
- D. Installation of Control-Circuit Conductors:
1. Install wiring in raceways.
 2. Use insulated spade lugs for wire and cable connection to screw terminals.
 3. Comply with requirements specified in Section 280533 "Raceways and Boxes for Electronic Safety and Security."
- E. Installation of Fire Alarm Wiring and Cables:
1. Install wiring in raceways.
 2. Use insulated spade lugs for wire and cable connection to screw terminals.
 3. Comply with requirements specified in Section 280533 "Raceways and Boxes for Electronic Safety and Security."
- F. Installation of Cables other than Fire Alarm Wiring:
1. Install wiring in raceways.
 - a. Comply with requirements specified in Section 280533 "Raceways and Boxes for Electronic Safety and Security."
 2. Open-Cable Installation:
 - a. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - b. Suspend copper cable not in a wireway or pathway a minimum of **8 inch (200 mm)** above ceilings by cable supports not more than **30 inch (760 mm)** apart.
 - c. Do not allow cables to lie on removable ceiling tiles.
 - d. Fasten securely in place with hardware specifically designed and installed so as to not damage cables.

SECTION 280523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES (continued):

- e. Cable must not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

3.03 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified with a tag for future use.

3.04 CONTROL-CIRCUIT CONDUCTORS

- A. Minimum Conductor Sizes:
 - 1. Class 1 remote-control and signal circuits; No 14 AWG.
 - 2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
 - 3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

3.05 FIRESTOPPING

- A. Comply with requirements in Division 07 "Penetration Firestopping."

3.06 GROUNDING

- A. For control-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.07 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 280553 "Identification for Electronic Safety and Security."

END OF SECTION 2860523

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SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. One or more security access networked workstations.
 - 2. Security access operating system and application software.
 - 3. Security access controllers connected to high-speed electronic-data transmission network.
- B. Related Requirements:
 - 1. Section 281500 "Access Control System Hardware Devices" for access control system hardware, such as keypads, card readers, and biometric identity devices.
 - 2. Section 282300 "Video Surveillance Control and Management Systems" to integrate video surveillance management system interface and control.
 - 3. Section 283100 "Intrusion Detection" to integrate intrusion detection system..

1.03 DEFINITIONS

- A. Credential: Data assigned to an entity and used to identify that entity.
- B. DTS: Digital Termination Service. A microwave-based, line-of-sight communication provided directly to the end user.
- C. Identifier: A credential card; keypad personal identification number; or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.
- D. Location: A Location on the TCP/IP network having a network controller-to-node controller communications link. Where this term is presented with an initial capital letter, this definition applies.
- E. Network Controller: Top tier of network-enabled architecture connected by a TCP/IP network and manageable from any network-connected PC with a browser.
- F. Node Controller: Field-installed controller at each Location connected to the system's inputs, outputs, and readers that manages access control decisions with data provided by the Network Controller.
- G. RAS: Remote access services.
- H. RF: Radio frequency.
- I. ROM: Read-only memory. ROM data are maintained through losses of power.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

- J. SMS: Security Management System.
- K. TCP/IP: Transport control protocol/Internet protocol.
- L. TWAIN: Technology without an Interesting Name. A programming interface that lets a graphics application, such as an image editing program or desktop publishing program, activate a scanner, frame grabber, or other image-capturing device.
- M. VMS: Video Management System.
- N. WMP: Windows media player.
- O. Wiegand: Patented magnetic principle that uses specially treated wires embedded in the credential card.
- P. WYSIWYG: What You See Is What You Get. Text and graphics appear on the screen the same as they will in print.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Reference each product to a location on Drawings. Test and evaluation data presented in Product Data shall comply with SIA BIO-01.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 "Operation and Maintenance Data," include the following:
 - 1. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on USB media of the hard-copy submittal.
 - 2. System installation and setup guides with data forms to plan and record options and setup decisions.

1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Laser Printers: Three toner cassettes and one replacement drum unit.
 - 2. Credential card blanks, ready for printing. Include enough credential cards for all personnel to be enrolled at the site plus an extra 50 percent for future use.
 - 3. Fuses of all kinds, power and electronic, equal to 10 percent of amount installed for each size used, but no fewer than three units.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 - 1. Cable installer must have on staff an RCDD certified by Building Industry Consulting Service International.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

- B. Integrator Qualifications: An employer of workers trained and approved by manufacturer.
 - 1. The security system integrator shall have been regularly engaged in the installation and maintenance of integrated access control systems and have a proven track record with similar systems of the same size, scope, and complexity.
 - 2. The security system integrator shall supply information attesting to the fact that their firm is an authorized product integrator certified with the SMS. A minimum of one technician shall be a Certified SMS installer.
 - 3. The security system integrator shall supply information attesting to the fact that their installation and service technicians are competent factory trained and certified personnel capable of maintaining the system and providing reasonable service time.
 - 4. The security system integrator shall provide a minimum of three (3) references whose systems are of similar complexity and have been installed and maintained by the security system integrator in the last five (5) years.
 - 5. There shall be a local representative and factory authorized local service organization that shall carry a complete stock of parts and provide maintenance for these systems.
- C. Source Limitations: Obtain network controllers, node controllers, \and all software through one source from single manufacturer.
- D. Installation shall comply with federal, state, and local codes and authorities having jurisdiction (AHJ).
- E. All software and hardware shall be programmed and installed in accordance with manufacturer's specifications.
- F. All equipment shall be new, in current production, and the standard products of a manufacturer of ESS equipment.
- G. The manufacturer shall guarantee availability of parts, for a minimum of seven (7) years from date of shipment.
- H. On-site maintenance and repair service shall be available locally and within four (4) hours of notification of condition.
- I. Software integration between all integrated systems shall be tested and certified for interoperability by the manufacturer of each system.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Controllers:
 - 1. Store in temperature- and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 deg F (10 and 30 deg C), and not more than 80 percent relative humidity, noncondensing.
 - 2. Open each container; verify contents against packing list; and file copy of packing list, complete with container identification, for inclusion in operation and maintenance data.
 - 3. Mark packing list with the same designations assigned to materials and equipment for recording in the system labeling schedules that are generated by software specified in "Cable and Asset Management Software" Article.
 - 4. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

1.09 PROJECT CONDITIONS

- A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
1. Control Station: Rated for continuous operation in ambient conditions of 60 to 85 deg F (16 to 30 deg C) and a relative humidity of 20 to 80 percent, noncondensing.
 2. Indoor, Controlled Environment: NEMA 250, Type 1 enclosure. System components, except the central-station control unit, installed in temperature-controlled indoor environments shall be rated for continuous operation in ambient conditions of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
 3. Indoor, Uncontrolled Environment: NEMA 250, Type 12 enclosures. System components installed in non-temperature-controlled indoor environments shall be rated for continuous operation in ambient conditions of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
 4. Outdoor Environment: NEMA 250, Type 3R or Type 4 enclosures. System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation where exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h).
 5. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
 6. Corrosive Environment: For system components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X enclosures.

PART 2 - PRODUCTS

2.01 ACCESS CONTROL SOFTWARE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide LENEL S2; or comparable product by one of the following:
1. Continental Access; CA4K.
 2. Honeywell Commercial Security; Pro-Watch or WIN-PAK.
 3. Kantech; EntraPass.
 4. Software House; CCure9000.
 5. Motorola Solutions: ACM.

2.02 DESCRIPTION

- A. Security Access System: Network-enabled architecture with multiple tiered, modular hardware hierarchy consisting of network controllers and field-installed node controllers, connected by a TCP/IP network and manageable from any network-connected PC with a browser. .
- B. System Software: Software shall have the following capabilities:
1. Multiuser and multitasking to allow for independent activities and monitoring to occur simultaneously at different workstations.
 2. Graphical user interface to show pull-down menus and a menu-tree format that complies with interface guidelines of the operating system.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

3. System license for the entire system including capability for future additions that are within the indicated system size limits specified in this Section.
4. Open-architecture system that allows importing and exporting of data and interfacing with other systems that are compatible with operating system.
5. Password-protected operator login and access.
6. Open-database-connectivity compliant.

2.03 OPERATION

- A. Security access system shall use a single database for access-control and credential-creation functions.
- B. Distributed Processing: A fully distributed processing system.
 1. Access-control information, including time, date, valid codes, access levels, and similar data, shall be downloaded to controllers so each controller can make access-control decisions.
 2. Intermediate controllers for access control are prohibited.
 3. In the event that communications with the central controller are lost, controllers shall automatically buffer event transactions until communications are restored, at which time buffered events shall be uploaded to the central station.
- C. Data Capacity:
 1. 64 different card-reader formats.
 2. 48 graphic file types for importing maps.
- D. Location Capacity:
 1. 1024 reader-controlled doors.
 2. Unlimited total-access credentials.
 3. 2048 supervised alarm inputs.
 4. 2048 programmable outputs.
- E. System Network Requirements:
 1. System components shall be interconnected and shall provide automatic communication of status changes, commands, field-initiated interrupts, and other communications required for proper system operation.
 2. Communication shall not require operator initiation or response and shall return to normal after partial- or total-network interruption such as power loss or transient upset.
 3. System shall automatically annunciate communication failures to the operator and shall identify the communications link that has experienced a partial or total failure.
- F. Network controller shall provide operator interface, interaction, display, control, and dynamic and real-time monitoring. Network controller shall control system networks to interconnect all system components, including field-installed node controllers.
- G. Field equipment shall include controllers, sensors, and controls.
 1. Controllers shall serve as an interface between the network controller and sensors and controls.
 2. Data exchange between the network controller and the node controllers shall include down-line transmission of commands, software, and databases to controllers.
 3. The up-line data exchange from the node controller to the network controller shall include status data such as intrusion alarms, status reports, and entry-control records.
 4. Controllers are classified as alarm-annunciation or entry-control type.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

H. System Response to Alarms:

1. Field device network shall provide a system end-to-end response time of one second(s) or less for every device connected to the system.
2. Alarms shall be annunciated at the network controller within one second of the alarm occurring at a controller or at a device controlled by a local controller, and within 100 ms if the alarm occurs at the central station.
3. Alarm and status changes shall be displayed within 100 ms after receipt of data by the central station.
4. All graphics shall be displayed, including graphics-generated map displays, on the console monitor within five seconds of alarm receipt at the security console.

I. False-Alarm Reduction: The design of the central station and controllers shall contain features to reduce false alarms. Equipment and software shall comply with SIA CP-01.

J. Error Detection:

1. Use a cyclic code method to detect single- and double-bit errors, burst errors of eight bits or fewer, and at least 99 percent of all other multibit and burst errors between controllers and the central station.
2. Interactive or product error-detection codes alone will not be acceptable.
3. A message shall be in error if one bit is received incorrectly.
4. Retransmit messages with detected errors.
5. Allow for an operator-assigned two-digit decimal number to each communications link representing the number of retransmission attempts.
6. Central station shall print a communication failure alarm message when the number of consecutive retransmission attempts equals the assigned quantity.
7. Monitor the frequency of data transmission failure for display and logging.

K. Data Line Supervision: System shall initiate an alarm in response to opening, closing, shorting, or grounding of data transmission lines.

L. Door Hardware Interface:

1. Comply with requirements in Division 08 for door hardware required to be monitored or controlled by the security access system.
2. Electrical characteristics of controllers shall match the signal and power requirements of door hardware.

2.04 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70, "National Electrical Code."

2.05 APPLICATION SOFTWARE

A. System Software: Embedded operating system and application software.

1. Multiuser multitasking shall allow independent activities and monitoring to occur simultaneously at different workstations.
2. Graphical user interface shall show pull-down menus and a menu-tree format.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

3. Capability for future additions within the indicated system size limits.
 4. Open architecture that allows importing and exporting of data and interfacing with other systems that are compatible with operating system.
 5. Password-protected operator login and access.
- B. Application Software: Interface between the alarm annunciation and entry-control controllers to monitor sensors, operate displays, report alarms, generate reports, and help train system operators.
1. Reside at the network controller and node controllers as required to perform specified functions.
 2. Operate and manage peripheral devices.
 3. Manage files for disk I/O, including creating, deleting, and copying files; and automatically maintain a directory of all files, including size and location of each sequential and random-ordered record.
 4. Import custom icons into graphics to represent alarms and I/O devices.
 5. Globally link I/O so that any I/O can link to any other I/O within the same Location without requiring interaction with the host workstation. This operation shall be at the controller.
 6. Globally code I/O links so that any access-granted event can link to any I/O with the same Location without requiring interaction with the host workstation. This operation shall be at the controller.
 7. Messages from workstation to controllers and controllers to controllers shall be on a polled network that utilizes check summing and acknowledgment of each message. Communication shall be automatically verified, buffered, and retransmitted if message is not acknowledged.
 8. Selectable poll frequency and message time-out settings shall handle bandwidth and latency issues for TCP/IP, RF, and other network controller-to-node controller communications methods by changing the polling frequency and the amount of time the system waits for a response.
 9. Automatic and encrypted backups for database and history backups shall be automatically stored at the SMS server and encrypted with a nine-character alphanumeric password that must be used to restore or read data contained in backup.
 10. Operator audit trail for recording and reporting all changes made to database and system software.
 11. Support network protocol and topology, TCP/IP, Novel Netware, Digital Pathworks, Banyan Vines, LAN/WAN, and RAS.
- C. Node Controller Software:
1. Controllers shall operate as autonomous, intelligent processing units.
 - a. Controllers shall make decisions about access control, alarm monitoring, linking functions, and door-locking schedules for their operation, independent of other system components.
 - b. Controllers shall be part of a fully distributed processing-control network.
 - c. The portion of the database associated with a controller, and consisting of parameters, constraints, and the latest value or status of points connected to that controller, shall be maintained in the controller.
 2. The following functions shall be fully implemented and operational within each controller:
 - a. Monitoring inputs.
 - b. Controlling outputs.
 - c. Automatically reporting alarms to the central station.
 - d. Reporting of sensor and output status to the central station on request.
 - e. Maintaining real time, automatically updated by the network controller at least once a day.
 - f. Communicating with the network controller.
 - g. Executing controller resident programs.
 - h. Diagnosing.
 - i. Downloading and uploading data to and from the central station.
 3. Controller Operations at a Location:

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

- a. In the event of communication failure between the network controller and a Location, there shall be no degradation in operations at the controllers at that Location. Controllers at each Location shall be connected to a memory buffer with a capacity to store up to 10,000 events; there shall be no loss of transactions in system history files until the buffer overflows.
 - b. Buffered events shall be handled in a first-in-first-out mode of operation.
 - 4. Individual Controller Operation:
 - a. Controllers shall transmit alarms, status changes, and other data to the network controller when communications circuits are operable. If communications are not available, controllers shall function in a stand-alone mode; operational data, including the status and alarm data normally transmitted to the central station, shall be stored for later transmission to the network controller. Storage capacity for the latest 1024 events shall be provided at each controller.
 - b. Card-reader ports of a controller shall be custom configurable for at least 64 different card-reader or keypad formats. Multiple reader or keypad formats may be used simultaneously at different controllers or within the same controller.
 - c. Controllers shall provide a response to card readers or keypad entries in less than 0.25 seconds, regardless of system size.
 - d. Controllers that are reset, or powered up from a nonpowered state, shall automatically request a parameter download and reboot to their proper working state. This shall happen without any operator intervention.
 - e. Initial Startup: When controllers are brought on-line, database parameters shall be automatically downloaded to them. After initial download is completed, only database changes shall be downloaded to each controller.
 - f. On failure for any reason, controllers shall perform an orderly shutdown and force controller outputs to a predetermined failure-mode state, consistent with the failure modes shown and the associated control device.
 - g. After power is restored, following a power failure, startup software shall initiate self-test diagnostic routines, after which controllers shall resume normal operation.
 - h. After controller failure, if the database and application software are no longer resident, controllers shall not restart but shall remain in the failure mode until repaired. If database and application programs are resident, controllers shall immediately resume operation. If not, software shall be restored automatically from the network controller.
 - 5. Communications Monitoring:
 - a. System shall monitor and report status of TCP/IP communications of each Location.
 - b. Communication status window shall display which controllers are currently communicating, a total count of missed polls since midnight, and which controller last missed a poll.
 - c. Communication status window shall show the type of CPU, the type of I/O board, and the amount of RAM for each controller.
 - 6. Operating systems shall include a real-time clock function that maintains seconds, minutes, hours, day, date, and month. The real-time clock shall be automatically synchronized with the central station at least once a day to plus or minus 10 seconds. The time synchronization shall be automatic, without operator action and without requiring system shutdown.
- D. Operator Interface:
- 1. Inputs in system shall have two icon representations, one for the normal state and one for the abnormal state.
 - 2. When viewing and controlling inputs, displayed icons shall automatically change to the proper icon to display the current system state in real time. Icons shall also display the input's state,

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

- whether armed or bypassed, and if the input is in the armed or bypassed state due to a time zone or a manual command.
3. Outputs in system shall have two icon representations, one for the secure (locked) state and one for the open (unlocked) state.
 4. Icons displaying status of the I/O points shall be constantly updated to show their current real-time condition without prompting by the operator.
 5. The operator shall be able to scroll the list of I/Os and press the appropriate toolbar button, or right click, to command the system to perform the desired function.
 6. Graphic maps or drawings containing inputs, outputs, and override groups shall include the following:
 - a. Database to import and store full-color maps or drawings and allow for input, output, and override group icons to be placed on maps.
 - b. Maps to provide real-time display animation and allow for control of points assigned to them.
 - c. System to allow inputs, outputs, and override groups to be placed on different maps.
 - d. Software to allow changing the order or priority in which maps will be displayed.
 7. Override Groups Containing I/Os:
 - a. System shall incorporate override groups that provide the operator with the status and control over user-defined "sets" of I/Os with a single icon.
 - b. Icon shall change automatically to show the live summary status of points in that group.
 - c. Override group icon shall provide a method to manually control or set to time-zone points in the group.
 - d. Override group icon shall allow the expanding of the group to show icons representing the live status for each point in the group, individual control over each point, and the ability to compress the individual icons back into one summary icon.
 8. Schedule Overrides of I/Os and Override Groups:
 - a. To accommodate temporary schedule changes that do not fall within the holiday parameters, the operator shall have the ability to override schedules individually for each input, output, or override group.
 - b. Each schedule shall be composed of a minimum of two dates with separate times for each date.
 - c. The first time and date shall be assigned the override state that the point shall advance to when the time and date become current.
 - d. The second time and date shall be assigned the state that the point shall return to when the time and date become current.
 9. Copy command in database shall allow for like data to be copied and then edited for specific requirements, to reduce redundant data entry.
- E. Operator Access Control:
1. Control operator access to system controls through three password-protected operator levels. System operators and managers with appropriate password clearances shall be able to change operator levels for operators.
 2. Three successive attempts by an operator to execute functions beyond their defined level during a 24-hour period shall initiate a software tamper alarm.
 3. A minimum of 1024 unique user accounts shall be available with the system software. System shall display the operator's name or initials in the console's first field. System shall print the operator's name or initials, action, date, and time on the system printer at login and logoff.
 4. The password shall not be displayed or printed.
 5. Each password shall be definable and assignable for the following:

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

- a. Selected commands to be usable.
- b. Access to system software.
- c. Access to application software.
- d. Individual zones that are to be accessed.
- e. Access to database.

F. Operator Commands:

1. Command Input: Plain-language words and acronyms shall allow operators to use the system without extensive training or data-processing backgrounds. System prompts shall be a word, a phrase, or an acronym.
2. Command inputs shall be acknowledged and processing shall start in not less than one second(s).
3. Tasks that are executed by operator's commands shall include the following:
 - a. Acknowledge Alarms: Used to acknowledge that the operator has observed the alarm message.
 - b. Place Zone in Access: Used to remotely disable intrusion-alarm circuits emanating from a specific zone. System shall be structured so that console operator cannot disable tamper circuits.
 - c. Place Zone in Secure: Used to remotely activate intrusion-alarm circuits emanating from a specific zone.
 - d. System Test: Allows the operator to initiate a system-wide operational test.
 - e. Zone Test: Allows the operator to initiate an operational test for a specific zone.
 - f. Print reports.
 - g. Change Operator: Used for changing operators.
 - h. Security Lighting Controls: Allows the operator to remotely turn on or turn off security lights.
 - i. Display Graphics: Used to show any graphic displays implemented in the system. Graphic displays shall be completed within 20 seconds from time of operator command.
 - j. Run system tests.
 - k. Generate and format reports.
 - l. Request help with the system operation.
 - 1) Include in main menus.
 - 2) Provide unique, descriptive, context-sensitive help for selections and functions with the press of one function key.
 - 3) Provide navigation to specific topic from within the first help window.
 - 4) Help shall be accessible outside the application program.
 - m. Entry-Control Commands:
 - 1) Lock (secure) or unlock (open) each controlled entry and exit up to four times a day through time-zone programming.
 - 2) Arm or disarm each monitored input up to four times a day through time-zone programming.
 - 3) Enable or disable readers or keypads up to two times a day through time-zone programming.
 - 4) Enable or disable cards or codes up to four times a day per entry point through access-level programming.
4. Command Input Errors: Show operator input assistance when a command cannot be executed because of operator input errors. Assistance screen shall use plain-language words and phrases to explain why the command cannot be executed. Error responses that require an operator to look up a code in a manual or other document are not acceptable. Conditions causing operator assistance messages include the following:

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

- a. Command entered is incorrect or incomplete.
- b. Operator is restricted from using that command.
- c. Command addresses a point that is disabled or out of service.
- d. Command addresses a point that does not exist.
- e. Command is outside the system's capacity.

G. Alarms:

1. System Setup:

- a. Assign manual and automatic responses to incoming-point status change or alarms.
- b. Automatically respond to input with a link to other inputs, outputs, or operator-response plans; unique sound with use of WAV files; and maps or images that graphically represent the point location.
- c. Sixty-character message field for each alarm.
- d. Operator-response-action messages shall allow message length of at least 65,000 characters, with database storage capacity of up to 32,000 messages. Setup shall assign messages to access point.
- e. Secondary messages shall be assignable by the operator for printing to provide further information and shall be editable by the operator.
- f. Allow 25 secondary messages with a field of four lines of 60 characters each.
- g. Store the most recent 1000 alarms for recall by the operator using the report generator.

2. Software Tamper:

- a. Annunciate a tamper alarm when unauthorized changes to system database files are attempted. Three consecutive unsuccessful attempts to log onto system shall generate a software tamper alarm.
 - b. Annunciate a software tamper alarm when an operator or other individual makes three consecutive unsuccessful attempts to invoke functions beyond the authorization level.
 - c. Maintain a transcript file of the last 5000 commands entered at each central station to serve as an audit trail. System shall not allow write access to system transcript files by any person, regardless of their authorization level.
 - d. Allow only acknowledgment of software tamper alarms.
- 3. Read access to system transcript files shall be reserved for operators with the highest password authorization level available in system.
 - 4. Animated Response Graphics: Highlight alarms with flashing icons on graphic maps; display and constantly update the current status of alarm inputs and outputs in real time through animated icons.
 - 5. Multimedia Alarm Annunciation: WAV files to be associated with alarm events for audio annunciation or instructions.
 - 6. Alarm Handling: Each input may be configured so that an alarm cannot be cleared unless it has returned to normal, with options of requiring the operator to enter a comment about disposition of alarm. Allow operator to silence alarm sound when alarm is acknowledged.
 - 7. Alarm Automation Interface: High-level interface to central-station alarm automation software systems. Allows input alarms to be passed to and handled by automation systems in the same manner as burglar alarms, using a TIA 232-F ASCII interface.
 - 8. CCTV Alarm Interface: Allow commands to be sent to CCTV systems during alarms (or input change of state) through serial ports.
 - 9. Camera Control: Provides operator ability to select and control cameras from graphic maps.

H. Alarm Monitoring: Monitor sensors, controllers, and DTS circuits and notify operators of an alarm condition. Display higher-priority alarms first and, within alarm priorities, display the oldest unacknowledged alarm first. Operator acknowledgment of one alarm shall not be considered acknowledgment of other alarms nor shall it inhibit reporting of subsequent alarms.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

1. Displayed alarm data shall include type of alarm, location of alarm, and secondary alarm messages.
 2. Printed alarm data shall include type of alarm, location of alarm, date and time (to nearest second) of occurrence, and operator responses.
 3. Maps shall automatically display the alarm condition for each input assigned to that map if that option is selected for that input location.
 4. Alarms initiate a status of "pending" and require the following two handling steps by operators:
 - a. First Operator Step: "Acknowledged." This action shall silence sounds associated with the alarm. The alarm remains in the system "Acknowledged" but "Un-Resolved."
 - b. Second Operator Step: Operators enter the resolution or operator comment, giving the disposition of the alarm event. The alarm shall then clear.
 5. Each workstation shall display the total pending alarms and total unresolved alarms.
 6. Each alarm point shall be programmable to disallow the resolution of alarms until the alarm point has returned to its normal state.
 7. Alarms shall transmit to the central station in real time except for allowing connection time for dial-up locations.
 8. Alarms shall be displayed and managed from a minimum of four different windows.
 - a. Input Status Window: Overlay status icon with a large red blinking icon. Selecting the icon will acknowledge the alarm.
 - b. History Log Transaction Window: Display name, time, and date in red text. Selecting red text will acknowledge the alarm.
 - c. Alarm Log Transaction Window: Display name, time, and date in red. Selecting red text will acknowledge the alarm.
 - d. Graphic Map Display: Display a steady colored icon representing each alarm input location. Change icon to flashing red when the alarm occurs. Change icon from flashing red to steady red when the alarm is acknowledged.
 9. Once an alarm is acknowledged, the operator shall be prompted to enter comments about the nature of the alarm and actions taken. Operator's comments may be manually entered or selected from a programmed predefined list, or a combination of both.
 10. For locations where there are regular alarm occurrences, provide programmed comments. Selecting that comment shall clear the alarm.
 11. The time and name of the operator who acknowledged and resolved the alarm shall be recorded in the database.
 12. Identical alarms from the same alarm point shall be acknowledged at the same time the operator acknowledges the first alarm. Identical alarms shall be resolved when the first alarm is resolved.
 13. Alarm functions shall have priority over downloading, retrieving, and updating database from workstations and controllers.
 14. When a reader-controlled output (relay) is opened, the corresponding alarm point shall be automatically bypassed.
- I. Monitor Display: Display text and graphic maps that include zone status integrated into the display. Colors are used for the various components and current data. Colors shall be uniform throughout the system.
1. Color Code:
 - a. FLASHING RED: Alerts operator that a zone has gone into an alarm or that primary power has failed.
 - b. STEADY RED: Alerts operator that a zone is in alarm and alarm has been acknowledged.
 - c. YELLOW: Advises operator that a zone is in access.
 - d. GREEN: Indicates that a zone is secure and that power is on.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

2. Graphics:
 - a. Support 32,000 graphic display maps and allow import of maps from a minimum of 16 standard formats from another drawing or graphics program.
 - b. Allow I/O to be placed on graphic maps by the drag-and-drop method.
 - c. Operators shall be able to view the inputs, outputs, and the point's name by moving the mouse cursor over the point on the graphic map.
 - d. Inputs or outputs may be placed on multiple graphic maps. The operator shall be able to toggle to view graphic maps associated with I/Os.
 - e. Each graphic map shall have a display-order sequence number associated with it to provide a predetermined order when toggled to different views.
 - f. Camera icons shall have the ability to be placed on graphic maps that, when selected by an operator, will open a video window, display the camera associated with that icon, and provide pan-tilt-zoom control.
 - g. Input, output, or camera placed on a map shall allow the ability to arm or bypass an input, open or secure an output, or control the pan-tilt-zoom function of the selected camera.
- J. System test software enables operators to initiate a test of the entire system or of a particular portion of the system.
 1. Test Report: The results of each test shall be stored for future display or printout. The report shall document the operational status of system components.
- K. Report-Generator Software: Include commands to generate reports for displaying, printing, and storing on disk and tape. Reports shall be stored by type, date, and time. Report printing shall be the lowest-priority activity. Report-generation mode shall be operator selectable but set up initially as periodic, automatic, or on request. Include time and date printed and the name of operator generating the report. Report formats may be configured by operators.
 1. Automatic Printing: Setup shall specify, modify, or inhibit the report to be generated; the time the initial report is to be generated; the time interval between reports; the end of the period; and the default printer.
 2. Printing on Request: An operator may request a printout of any report.
 3. Alarm Reports: Reporting shall be automatic as initially set up. Include alarms recorded by system over the selected time and information about the type of alarm (such as door alarm, intrusion alarm, tamper alarm, etc.), the type of sensor, the location, the time, and the action taken.
 4. Access and Secure Reports: Document zones placed in access, the time placed in access, and the time placed in secure mode.
 5. Custom Reports: Reports tailored to exact requirements of who, what, when, and where. As an option, custom report formats may be stored for future printing.
 6. Automatic History Reports: Named, saved, and scheduled for automatic generation.
 7. Cardholder Reports: Include data, or selected parts of the data, as well as the ability to be sorted by name, card number, imprinted number, or by any of the user-defined fields.
 8. Cardholder by Reader Reports: Based on who has access to a specific reader or group of readers by selecting the readers from a list.
 9. Cardholder by Access-Level Reports: Display everyone that has been assigned to the specified access level.
 10. Who Is "In" (Muster) Report:
 - a. Emergency Muster Report: One-click operation on toolbar launches report.
 - b. Cardholder Report. Contain a count of persons who are "In" at a selected Location and a detailed listing of name, date, and time of last use, sorted by the last reader used or by the group assignment.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

11. Panel Labels Reports: Printout of control-panel field documentation including the actual location of equipment, programming parameters, and wiring identification. Maintain system installation data within system database so that data are available on-site at all times.
12. Activity and Alarm On-Line Printing: Activity printers for use at workstations; prints all events, or alarms only.
13. History Reports: Custom reports that allow the operator to select any date, time, event type, device, output, input, operator, Location, name, or cardholder to be included or excluded from the report.
 - a. Initially store history on the hard disk of the host workstation.
 - b. Permit viewing of the history on workstations or print history to any system printer.
 - c. The report shall be definable by a range of dates and times with the ability to have a daily start and stop time over a given date range.
 - d. Each report shall depict the date, time, event type, event description, and device; or I/O name, cardholder group assignment, and cardholder name or code number.
 - e. Each line of a printed report shall be numbered to ensure that the integrity of the report has not been compromised.
 - f. Total number of lines of the report shall be given at the end of the report. If the report is run for a single event such as "Alarms," the total shall reflect how many alarms occurred during that period.
14. Reports shall have the following four options:
 - a. View on screen.
 - b. Print to system printer. Include automatic print spooling and "Print To" options if more than one printer is connected to the system.
 - c. "Save to File" with full path statement.
 - d. System shall have the ability to produce a report indicating status of system inputs and outputs or of inputs and outputs that are abnormal, out of time zone, manually overridden, not reporting, or in alarm.
15. Custom Code List Subroutine: Allow the access codes of system to be sorted and printed according to the following criteria:
 - a. Active, inactive, or future activate or deactivate.
 - b. Code number, name, or imprinted card number.
 - c. Group, Location access levels.
 - d. Start and stop code range.
 - e. Codes that have not been used since a selectable number of days.
 - f. In, out, or either status.
 - g. Codes with trace designation.
16. The reports of system database shall allow options so that every data field may be printed.
17. The reports of system database shall be constructed so that the actual position of the printed data shall closely match the position of the data on the data-entry windows.

L. Anti-Passback:

1. System shall have global and local anti-passback features, selectable by Location. System shall support hard and soft anti-passback.
2. Hard Anti-Passback: Once a credential holder is granted access through a reader with one type of designation (IN or OUT), the credential holder may not pass through that type of reader designation until the credential holder passes through a reader of opposite designation.
3. Soft Anti-Passback: Should a violation of the proper IN or OUT sequence occur, access shall be granted, but a unique alarm shall be transmitted to the control station, reporting the credential holder and the door involved in the violation. A separate report may be run on this event.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

4. Timed Anti-Passback: A controller capability that prevents an access code from being used twice at the same device (door) within a user-defined amount of time.
5. Provide four separate zones per Location that can operate without requiring interaction with the host workstation (done at controller). Each reader shall be assignable to one or all four anti-passback zones. In addition, each anti-passback reader can be further designated as "Hard," "Soft," or "Timed" in each of the four anti-passback zones. The four anti-passback zones shall operate independently.
6. The anti-passback schemes shall be definable for each individual door.
7. The Master Access Level shall override anti-passback.
8. System shall have the ability to forgive (or reset) an individual credential holder or the entire credential-holder population anti-passback status to a neutral status.

M. Visitor Assignment:

1. Provide for and allow an operator to be restricted to only working with visitors. The visitor badging subsystem shall assign credentials and enroll visitors. Allow only those access levels that have been designated as approved for visitors.
2. Provide an automated log of visitor name, time and doors accessed, and name of person contacted.
3. Allow a visitor designation to be assigned to a credential holder.
4. Security access system shall be able to restrict the access levels that may be assigned to credentials issued to visitors.
5. Allow operator to recall visitors' credential-holder file once a visitor is enrolled in the system.
6. The operator may designate any reader as one that deactivates the credential after use at that reader. The history log shall show the return of the credential.
7. System shall have the ability to use the visitor designation in searches and reports. Reports shall be able to print all or any visitor activity.

N. Time and Attendance:

1. Time and attendance reporting shall be provided to match IN and OUT reads and display cumulative time in for each day and cumulative time in for length designated in the report.
2. Shall be provided to match IN and OUT reads and display cumulative time in for each day and cumulative time in for length designated in the report.
3. System software setup shall allow designation of selected access-control readers as time and attendance hardware to gather the clock-in and clock-out times of the users at these readers.
 - a. Reports shall show in and out times for each day, total time in for each day, and a total time in for period specified by the user.
 - b. Allow the operator to view and print the reports, or save the reports to a file.
 - c. Alphabetically sort reports on the person's last name, by Location or location group. Include all credential holders or optionally select individual credential holders for the report.

O. Training Software: Enables operators to practice system operation, including alarm acknowledgment, alarm assessment, response force deployment, and response force communications. System shall continue normal operation during training exercises and shall terminate exercises when an alarm signal is received at the console.

P. Entry-Control Enrollment Software: Database management functions that allow operators to add, delete, and modify access data as needed.

1. The enrollment station shall not have alarm response or acknowledgment functions.
2. Provide multiple, password-protected access levels. Database management and modification functions shall require a higher operator access level than personnel enrollment functions.
3. The program shall provide means to disable the enrollment station when it is unattended, to prevent unauthorized use.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

4. The program shall provide a method to enter personnel identifying information into the entry-control database files through enrollment stations. In the case of personnel identity-verification subsystems, this shall include biometric data. Allow entry of personnel identifying information into the system database using menu selections and data fields. The data field names shall be customized during setup to suit user and site needs. Personnel identity-verification subsystems selected for use with the system shall fully support the enrollment function and shall be compatible with the entry-control database files.
5. Cardholder Data: Provide 99 user-defined fields. System shall have the ability to run searches and reports using any combination of these fields. Each user-defined field shall be configurable, using any combination of the following features:
 - a. MASK: Determines a specific format with which data must comply.
 - b. REQUIRED: Operator is required to enter data into field before saving.
 - c. UNIQUE: Data entered must be unique.
 - d. DEACTIVATE DATE: Data entered will be evaluated as an additional deactivate date for all cards assigned to this cardholder.
 - e. NAME ID: Data entered will be considered a unique ID for the cardholder.
6. Personnel Search Engine: A report generator with capabilities such as search by last name, first name, group, or any predetermined user-defined data field; by codes not used in definable number of days; by skills; or by seven other methods.
7. Multiple Deactivate Dates for Cards: User-defined fields to be configured as additional stop dates to deactivate any cards assigned to the cardholder.
8. Batch card printing.
9. Default card data can be programmed to speed data entry for sites where most card data are similar.
10. Enhanced ASCII File Import Utility: Allows the importing of cardholder data and images.
11. Card Expire Function: Allows readers to be configured to deactivate cards when a card is used at selected devices.

2.06 SYSTEM DATABASE

- A. Database and database management software shall define and modify each point in database using operator commands. Definition shall include parameters and constraints associated with each system device.
- B. Database Operations:
 1. System data management shall be in a hierarchical menu-tree format, with navigation through expandable menu branches and manipulated with use of menus and icons in a main menu and system toolbar.
 2. Navigational Aids:
 - a. Toolbar icons for add, delete, copy, print, capture image, activate, deactivate, and muster report.
 - b. Point and click feature to facilitate data manipulation.
 - c. Next and previous command buttons visible when editing database fields to facilitate navigation from one record to the next.
 - d. Copy command and copy tool in the toolbar to copy data from one record to create a new similar record.
 3. Data entry shall be automatically checked for duplicate and illegal data and shall be verified for valid format.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

4. System shall generate a memo or note field for each item that is stored in database, allowing the storing of information about any defining characteristics of the item. Memo field is used for noting the purpose for which the item was entered, reasons for changes that were made, and the like.
- C. File Management:
1. File management shall include database backup and restoration system, allowing selection of storage media, including 3.5-inch floppy disk, Zip and Jaz drives, and designated network resources.
 2. Operations shall be both manual and automatic modes. The number of automatic sequential backups before the oldest backup will be overwritten; FIFO mode shall be operator selectable.
 3. Backup program shall provide manual operation from any workstation on the LAN and shall operate while system remains operational.
- D. Operator Passwords:
1. Support up to 32,000 individual system operators, each with a unique password.
 2. One to eight alphanumeric characters.
 3. Allow passwords to be case sensitive.
 4. Passwords shall not be displayed when entered.
 5. Passwords shall have unique and customizable password profile, and allow several operators to share a password profile. Include the following features in the password profile:
 - a. Predetermine the highest-level password profile for access to all functions and areas of program.
 - b. Allow or disallow operator access to any program operation, including the functions of View, Add, Edit, and Delete.
 - c. Restrict doors to which an operator can assign access.
 6. Operators shall use a user name and password to log on to system. This user name and password shall be used to access database areas and programs as determined by the associated profile.
 7. Make provision to allow the operator to log off without fully exiting program. User may be logged off but program will remain running while displaying the login window for the next operator.
- E. Access Card/Code Operation and Management: Access authorization shall be by card, by a manually entered code (PIN), or by a combination of both (card plus PIN).
1. Access authorization shall verify the facility code first, the card or card-and-PIN validation second, and the access level (time of day, day of week, date), anti-passback status, and number of uses last.
 2. Use data-entry windows to view, edit, and issue access levels. Access-authorization entry-management system shall maintain and coordinate all access levels to prevent duplication or the incorrect creation of levels.
 3. Allow assignment of multiple cards/codes to a cardholder.
 4. Allow assignment of up to four access levels for each Location to a cardholder. Each access level may contain any combination of doors.
 5. Each door may be assigned four time zones.
 6. Access codes may be up to 11 digits in length.
 7. Software shall allow the grouping of locations so cardholder data can be shared by all locations in the group.
 8. Visitor Access: Issue a visitor badge for data tracking or photo ID purposes without assigning that person a card or code.
 9. Cardholder Tracing: Allow for selection of cardholder for tracing. Make a special audible and visible annunciation at control station when a selected card or code is used at a designated code reader. Annunciation shall include an automatic display of the cardholder image.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

10. Allow each cardholder to be given either an unlimited number of uses or a number from one to 9999 that regulates the number of times the card can be used before it is automatically deactivated.
 11. Provide for cards and codes to be activated and deactivated manually or automatically by date. Provide for multiple deactivate dates to be preprogrammed.
- F. Security Access Integration:
1. Photo ID badging and photo verification shall use the same database as the security access and may query data from cardholder, group, and other personal information to build a custom ID badge.
 2. Automatic or manual image recall and manual access based on photo verification shall also be a means of access verification and entry.
 3. System shall allow sorting of cardholders together by group or other characteristic for a fast and efficient method of reporting on, and enabling or disabling, cards or codes.
- G. Key control and tracking shall be an integrated function of cardholder data.
1. Provide the ability to store information about which conventional metal keys are issued and to whom, along with key construction information.
 2. Reports shall be designed to list everyone who possesses a specified key.
- H. Facility Codes: System shall accommodate up to 2048 facility codes per Location, with the option of allowing facility codes to work at all doors or only at particular doors.
- I. Operator Comments:
1. With the press of one appropriate button on the toolbar, the user shall be permitted to enter operator comments into the history at any time.
 2. Automatic prompting of operator comment shall occur before the resolution of each alarm.
 3. Operator comments shall be recorded by time, date, and operator number.
 4. Comments shall be sorted and viewed through reports and history.
 5. The operator may enter comments in two ways; either or both may be used:
 - a. Manually entered through keyboard data entry (typed), up to 65,000 characters per each alarm.
 - b. Predefined and stored in database for retrieval on request.
 6. System shall have a minimum of 999 predefined operator comments with up to 30 characters per comment.
- J. Group:
1. Group names may be used to sort cardholders into groups that allow the operator to determine the tenant, vendor, contractor, department, division, or any other designation of a group to which the person belongs.
 2. System software shall have the capacity to assign one of 32,000 group names to an access authorization.
 3. Make provision in software to deactivate and reactivate all access authorizations assigned to a particular group.
 4. Allow sorting of history reports and code list printouts by group name.
- K. Time Zones:
1. Each zone consists of a start and stop time for seven days of the week and three holiday schedules. A time zone is assigned to inputs, outputs, or access levels to determine when an input shall

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

automatically arm or disarm, when an output automatically opens or secures, or when access authorization assigned to an access level will be denied or granted.

2. Up to four time zones may be assigned to inputs and outputs to allow up to four arm or disarm periods per day or four lock or unlock periods per day; up to three holiday override schedules may be assigned to a time zone.
3. Data-entry window shall display a dynamically linked bar graph showing active and inactive times for each day and holiday, as start and stop times are entered or edited.
4. System shall have the capacity for 2048 time zones for each Location.

L. Holidays:

1. Three different holiday schedules may be assigned to a time zone. Holiday schedule consists of date in format MM/DD/YYYY and a description. When the holiday date matches the current date of the time zone, the holiday schedule replaces the time-zone schedule for that 24-hour period.
2. System shall have the capacity for 32,000 holidays.
3. Three separate holiday schedules may be applied to a time zone.
4. Holidays have an option to be designated as occurring on the designated date each year. These holidays remain in the system and will not be purged.
5. Holidays not designated to occur each year shall be automatically purged from the database after the date expires.

M. Access Levels:

1. System shall allow for the creation of up to 32,000 access levels.
2. One level shall be predefined as the Master Access Level. The Master Access Level shall work at all doors at all times and override any anti-passback.
3. System shall allow for access to be restricted to any area by reader and by time. Access levels shall determine when and where an Identifier is authorized.
4. System shall be able to create multiple door and time-zone combinations under the same access level so that an Identifier may be valid during different time periods at different readers even if the readers are on the same controller.

N. User-Defined Fields:

1. System shall provide a minimum of 99 user-defined fields, each with up to 50 characters, for specific information about each credential holder.
2. System shall accommodate a title for each field; field length shall be 20 characters.
3. A "Required" option may be applied to each user-defined field that, when selected, forces the operator to enter data in the user-defined field before the credential can be saved.
4. A "Unique" option may be applied to each user-defined field that, when selected, will not allow duplicate data from different credential holders to be entered.
5. Data format option may be assigned to each user-defined field that will require the data to be entered with certain character types in specific spots in the field entry window.
6. A user-defined field, if selected, will define the field as a deactivate date. The selection shall automatically cause the data to be formatted with the windows MM/DD/YYYY date format. The credential of the holder will be deactivated on that date.
7. A search function shall allow any one user-defined field or combination of user-defined fields to be searched to find the appropriate cardholder. The search function shall include a search for a character string.
8. System shall have the ability to print cardholders based on and organized by the user-defined fields.

O. Code Tracing:

1. System shall perform code tracing selectable by cardholder and by reader.
2. Any code may be designated as a "traced code" with no limit to how many codes can be traced.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

3. Any reader may be designated as a "trace reader" with no limit to which or how many readers can be used for code tracing.
4. When a traced code is used at a trace reader, the access-granted message that usually appears on the monitor window of the central station shall be highlighted with a different color than regular messages. A short singular beep shall occur at the same time the highlighted message is displayed on the window.
5. The traced cardholder image (if image exists) shall appear on workstations when used at a trace reader.

2.07 SURGE AND TAMPER PROTECTION

- A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor-entry connection to components.
 1. Minimum Protection for Power Connections 120 V and More: Auxiliary panel suppressors complying with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."
 2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits" as recommended by manufacturer for type of line being protected.
- B. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station control-unit alarm display shall identify tamper alarms and indicate locations.

2.08 NETWORK CONTROLLER HARDWARE

- A. Description: The Network Controller shall contain the operating system, database engine, web server, application software, and configuration data.
- B. Servers:
 1. Mounting: Rack blade.
 2. Power: Single power supply.
 3. Performance Requirements:
 - a. Performance requirements may dictate equipment exceeding minimum requirements indicated.
 - b. Energy Star compliant.
 4. Processor:
 - a. Minimum Speed: 2.5 GHz,
 - b. Cores: Dual.
 5. RAM:
 - a. Capacity: 8 GB.
 6. Hard Drives: Solid state.
 7. Network Interface: Single port Gigabit Ethernet.
 8. Web Server:

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

- a. Firewalls between server Web and networks.
 - b. Software licenses.
 - c. Password protection for access to server from Web server.
 - d. Cable installation between the server(s) and building Ethernet network.
9. Power each server through a UPS unit.
10. Support communication for each node controller with minimum 20% spare capacity allowance.
11. Server Requirements:
 - a. Operating System: Microsoft Windows
 - b. Network Interface: 1000BASE-T Ethernet
12. Acceptable Web Browsers:
 - a. PC: Internet Explorer, Firefox, Safari, Opera, Chrome, all non-JavaScript browsers.
 - b. HTML Compliance: HTML 4.0

2.09 NODE CONTROLLERS

- A. Description: Field-installed controller at each Location connected to the system's inputs, outputs, and readers that manages access control decisions with data provided by the Network Controller.
- B. Controllers: Intelligent peripheral control unit, complying with UL 294, that stores time, date, valid codes, access levels, and similar data downloaded from the central station or workstation for controlling its operation.
- C. Alarm Annunciation:
 1. The controller shall automatically restore communication within 10 seconds after an interruption with the field device network.
 - a. Inputs: Monitor dry contacts for changes of state that reflect alarm conditions. Provides at least eight alarm inputs, which are suitable for wiring as normally open or normally closed contacts for alarm conditions.
 - b. Alarm-Line Supervision:
 - 1) Supervise the alarm lines by monitoring each circuit for changes or disturbances in the signal using dc change measurements. System shall initiate an alarm in response to an abnormal current, which is a dc change of 10 percent or more for longer than 500 ms.
 - 2) Transmit alarm-line-supervision alarm to the central station during the next interrogation cycle after the abnormal current condition.
 - c. Outputs: Managed by network controller software.
 2. Auxiliary Equipment Power: A GFI service outlet inside the controller enclosure.
- D. Entry-Control:
 1. Function: Provide local entry-control functions including one- and two-way communications with access-control devices such as card readers, keypads, biometric personnel identity-verification devices, door strikes, magnetic latches, gate and door operators, and exit push buttons.
 - a. Operate as a stand-alone portal controller using the downloaded database during periods of communication loss between the controller and the field-device network.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

- b. Accept information generated by the entry-control devices; automatically process this information to determine valid identification of the individual present at the portal:
 - 1) On authentication of the credentials or information presented, check privileges of the identified individual, allowing only those actions granted as privileges.
 - 2) Privileges shall include, but are not limited to, time of day control, day of week control, group control, and visitor escort control.
 - c. Maintain a date-, time-, and Location-stamped record of each transaction. A transaction is defined as any successful or unsuccessful attempt to gain access through a controlled portal by the presentation of credentials or other identifying information.
2. Inputs:
- a. Data from entry-control devices; use this input to change modes between access and secure.
 - b. Database downloads and updates from the central station that include enrollment and privilege information.
3. Outputs:
- a. Indicate success or failure of attempts to use entry-control devices and make comparisons of presented information with stored identification information.
 - b. Grant or deny entry by sending control signals to portal-control devices and mask intrusion-alarm annunciation from sensors stimulated by authorized entries.
 - c. Maintain a date-, time-, and Location-stamped record of each transaction and transmit transaction records to the central station.
 - d. Door Prop Alarm: If a portal is held open for longer than 20 seconds, alarm sounds.
4. With power supplies sufficient to power at voltage and frequency required for field devices and portal-control devices.
5. Data Line Problems: For periods of loss of communication with the central station, or when data transmission is degraded and generating continuous checksum errors, the controller shall continue to control entry by accepting identifying information, making authentication decisions, checking privileges, and controlling portal-control devices.
- a. Store up to 1000 transactions during periods of communication loss between the controller and access-control devices for subsequent upload to the central station on restoration of communication.
6. Controller Power: NFPA 70, Class II power-supply transformer, with 12- or 24-V dc secondary, backup battery and charger.
- a. Backup Battery: Valve-regulated, recombinant-sealed, lead-acid battery; spill proof. With single-stage, constant-voltage-current, limited battery charger, comply with battery manufacturer's written instructions for battery terminal voltage and charging current recommendations for maximum battery life.
 - b. Backup Power-Supply Capacity: Sufficient power to provide for an orderly shutdown of the system in case of loss of external power.
 - c. Power Monitoring: Provide manual, dynamic battery-load test, initiated and monitored at the control center; with automatic disconnection of the controller when battery voltage drops below controller limits. Report by using local controller-mounted digital displays and by communicating status to central station. Indicate normal power on and battery charger on trickle charge. Indicate and report the following:
 - 1) Trouble Alarm: Normal power-off load assumed by battery.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

- 2) Trouble Alarm: Low battery.
- 3) Alarm: Power off.

2.10 ENROLLMENT CENTER

- A. Description: Integrated ID badging system with SMS. No extra licensing shall
- B. Equipment for enrolling personnel into, and removing personnel from, system database, using a dedicated desktop workstation
 1. Include equipment to enroll selected biometric credentials.
- C. Enrollment equipment shall support encoding of credential cards including cryptographic and other internal security checks as required for system.
 1. Allow only authorized entry-control enrollment personnel to access the enrollment equipment using passwords.
 2. Include enrollment-subsystem configuration controls and electronic diagnostic aids for subsystem setup and troubleshooting with the central station.
 3. Enrollment-station records printer shall meet requirements of the report printer.
- D. Entry-Control Enrollment Software:
 1. Shall include database management functions for the system, and shall allow an operator to change and modify the data entered in the system as needed.
 2. Software shall not have alarm response or acknowledgment functions as a programmable function.
 3. Multiple, password-protected access levels shall be provided at the enrollment station.
 4. Database management and modification functions shall require a higher operator-access level than personnel enrollment functions.
 5. Software shall provide a means for disabling the enrollment station when it is unattended, to prevent unauthorized use.
 6. Software shall provide a method to enter personnel identifying information into the entry-control database files through enrollment stations to include a credential unit in use at the installation.
 7. In the case of personnel identity-verification subsystems, this data shall include biometric data.
 8. Software shall allow entry of this data into the system database files through the use of simple menu selections and data fields. The data field names shall be customized to suit user and site needs.
 9. Personnel identity-verification subsystems selected for use with the system shall fully support the enrollment function and shall be compatible with the entry-control database files.
- E. Accessories:
 1. Steel desk-type console, swivel chair on casters, and equipment racks.
 2. Console and Equipment Racks: Comply with EIA/ECA-310-E.
 3. Equipment, with the exception of the printers, shall be rack mounted in the console and equipment racks.
 4. Storage Cabinet: Locking cabinet approximately 72 inches (1830 mm) high, 36 inches (915 mm) wide, and 24 inches (610 mm) deep, with three adjustable shelves and two storage racks.
- F. System Capacity: Number of badges shall be limited only by hard disk space. Badge templates and images shall be in color, supporting the maximum color capability of workstation operating system.
- G. Badge Configuration:

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

1. Software for badge template creation shall include a template consisting of background and predetermined locations of photographs, text objects and data fields for text, and bar-code and biometric information. Include automatic sizing of data fields placed on a badge to compensate for names, which may otherwise be too large to fit in the area designated.
 2. Allow different badge templates to be used for each department, tenant, or visitor.
 3. As a setup option, templates shall be automatically selected for the badge, based on the group to which the credential holder is assigned. Allow the operator to override the automatic template selection and use a template chosen by the operator for creating a badge.
 4. Setup shall determine which graphics and credential-holder information will be displayed and where on the card it will be placed. All data in the security access system, such as name, code, group, access level, and any of the 99 user-defined fields, shall be selectable, with the ability to place them anywhere on the card.
 5. System shall include an importing, filing, and recall system of stored images and shapes that can be placed on the badge.
 6. Allow multiple images on the same badge, including, but not limited to, bar codes, digital photos, and signatures.
 7. Support transparent backgrounds so that image is only surrounded by the intended background and not by its immediate background.
- H. Photo Imaging: Integral to security access.
1. Import images from bitmap file formats, digital cameras, TWAIN cameras, or scanners. Allow image cropping and editing, WYSIWYG badge-building application, and badge print-preview and printing capabilities.
 2. System shall support multiple images stored for each credential holder, including signatures, portrait views, and profile views.
- I. Text Objects: Badge configuration shall provide for creation of custom text as an object, allowing font selection, typing, scaling, and formatting of the text object. Formatting options shall include changing font, font size, text flow, and text alignment; bending or curving the text object into a circle or semicircle; applying 3-D effects; and applying predefined effects such as tilt, extrusion, or beveling. Text shall be placed and optionally automatically centered within any region of the badge layout.
- J. Badges and Credential Cards:
1. Badges are credential cards that do not contain data to be read by card readers.
 2. Credential cards shall store uniquely coded data used by card readers as an Identifier.
 - a. Proximity Cards: Use proximity detection without physical contact with the reader for proper operation.
 3. Allow entry-control card to be modified by lamination or direct print process during the enrollment process for use as a picture and identification badge without reduction of readability. The design shall allow for the addition of at least one slot or hole to accommodate the attachment of a clip for affixing the credential card to the type of badge holder used at the site.
 - a. Card Size and Dimensional Stability: Standard size, 2-1/8 by 3-3/8 inches (54 by 86 mm); dimensionally stable so that an undamaged card with deformations resulting from normal use shall be readable by the card reader.
 - b. Card Material: Abrasion resistant, nonflammable, and nontoxic; and impervious to solar radiation and effects of ultraviolet light.
 - c. Card Construction: Core and laminate or monolithic construction. Lettering, logos, and other markings shall be hot stamped into the credential material or direct printed.
 - 1) Incorporate phosphorous ink as a security enhancement.
 - 2) Furnish equipment for on-site assembly and lamination of credential cards.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

- d. Card Durability and Maintainability: Designed and constructed to yield a useful lifetime of at least five years or 5000 insertions or swipes, whichever results in a longer period of time. Allow credential cards to be cleaned by wiping with a sponge or cloth wetted with soap and water.
- K. Card-Making Equipment: Consisting of a workstation, video camera, video-imaging equipment, and a printer.
 - 1. Camera: NTSC color standard, RGB video output, 470 lines minimum horizontal resolution, and automatic white balance with full rated output under illumination of 0.5 fc (5 lx).
 - 2. Video Imaging: Live-image capture software and hardware and a digital signature capture pad.
 - 3. Standard workstation, modified as follows:
 - a. Redundant workstation is not required.
 - b. Printer is not required.
 - c. UPS is not required.
 - d. Sound card is not required.
 - 4. Printer: Dye-sublimation resin thermal transfer, 300 dpi resolution, 16.7 million colors, accepting cards ranging in size from 2.1 by 3 inches to 2.6 by 3.7 inches (53 by 76 mm to 66 by 94 mm) and having card thickness ranging from 0.020 to 0.060 inch (0.5 to 1.5 mm). Printer shall have options for encoding magnetic stripe using tracks 1, 2, and 3. Throughput shall be not less than 60 seconds per card.

2.11 DOOR AND GATE HARDWARE INTERFACE

- A. Exit Device with Alarm: Operation of the exit device shall generate an alarm. Exit device and alarm contacts are specified in Division 08 "Door Hardware."
- B. Exit Alarm: Operation of a monitored door shall generate an alarm. Exit devices and alarm contacts are specified in Division 08 "Door Hardware."
- C. Electric Door Strikes: Use end-of-line resistors to provide power-line supervision. Signal switches shall transmit data to controller to indicate when the bolt is not engaged and the strike mechanism is unlocked, and they shall report a forced entry. Power and signal shall be from the controller. Electric strikes are specified in Division 08 "Door Hardware."
- D. Electromagnetic Locks: End-of-line resistors shall provide power-line supervision. Lock status sensing signal shall positively indicate door is secure. Power and signal shall be from the controller. Electromagnetic locks are specified in Division 08 "Door Hardware."
- E. Vehicle Gate Operator: Interface electrical operation of gate with controls in this Section. Vehicle gate operators shall be connected, monitored, and controlled by the security access controllers. Vehicle gate and accessories are specified in Section 323113 "Chain Link Fences and Gates."

2.12 FIELD-PROCESSING SOFTWARE

- A. Operating System:
 - 1. Local processors shall contain an operating system that controls and schedules that local processor's activities in real time.
 - 2. Local processor shall maintain a point database in its memory that includes parameters, constraints, and the latest value or status of all points connected to that local processor.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

3. Execution of local processor application programs shall utilize the data in memory resident files.
4. Operating system shall include a real-time clock function that maintains the seconds, minutes, hours, date, and month, including day of the week.
5. Local processor real-time clock shall be automatically synchronized with the central station at least once per day to plus or minus 10 seconds (the time synchronization shall be accomplished automatically, without operator action and without requiring system shutdown).

B. Startup Software:

1. Causes automatic commencement of operation without human intervention, including startup of all connected I/O functions.
2. Local processor restart program based on detection of power failure at the local processor shall be included in the local processor software.
3. Initiates operation of self-test diagnostic routines.
4. Upon failure of the local processor, if the database and application software are no longer resident, the local processor shall not restart and systems shall remain in the failure mode indicated until the necessary repairs are made.
5. If the database and application programs are resident, the local processor shall immediately resume operation.

C. Operating Mode:

1. Local processors shall control and monitor inputs and outputs as specified, independent of communications with the central station or designated workstations.
2. Alarms, status changes, and other data shall be transmitted to the central station or designated workstations when communications circuits are operable.
3. If communications are not available, each local processor shall function in a stand-alone mode and operational data, including the status and alarm data normally transmitted to the central station or designated workstations, shall be stored for later transmission to the central station or designated workstations.
4. Storage for the latest 4000 events shall be provided at local processors, as a minimum.
5. Local processors shall accept software downloaded from the central station.
6. Panel shall support flash ROM technology to accomplish firmware downloads from a central location.

D. Failure Mode: Upon failure for any reason, each local processor shall perform an orderly shutdown and force all local processor outputs to a predetermined (failure-mode) state, consistent with the failure modes shown and the associated control device.

E. Functions:

1. Monitoring of inputs.
2. Control of outputs.
3. Reporting of alarms automatically to the central station.
4. Reporting of sensor and output status to central station upon request.
5. Maintenance of real time, automatically updated by the central station at least once a day.
6. Communication with the central station.
7. Execution of local processor resident programs.
8. Diagnostics.
9. Download and upload data to and from the central station.

2.13 FIELD-PROCESSING HARDWARE

A. Alarm Annunciation Local Processor:

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

1. Respond to interrogations from the field device network, recognize and store alarm status inputs until they are transmitted to the central station, and change outputs based on commands received from the central station.
2. Local processor shall also automatically restore communication within 10 seconds after an interruption with the field device network and provide dc line supervision on each of its alarm inputs.
3. Local processor inputs shall monitor dry contacts for changes of state that reflect alarm conditions.
4. Local processor shall have at least eight alarm inputs which allow wiring contacts as normally open or normally closed for alarm conditions; and shall provide line supervision for each input by monitoring each input for abnormal open, grounded, or shorted conditions using dc current change measurements.
5. Local processor shall report line supervision alarms to the central station.
6. Alarms shall be reported for any condition that remains abnormal at an input for longer than 500 milliseconds.
7. Alarm condition shall be transmitted to the central computer during the next interrogation cycle.
8. Local processor outputs shall reflect the state of commands issued by the central station.
9. Outputs shall be a form C contact and shall include normally open and normally closed contacts.
10. Local processor shall have at least four command outputs.
11. Local processor shall be able to communicate with the central station via RS-485 or TCP/IP as a minimum.

B. Processor Power Supply:

1. Local processor and sensors shall be powered from an uninterruptible power source.
2. Uninterruptible power source shall provide eight hours of battery back-up power in the event of primary power failure and shall automatically fully recharge the batteries within 12 hours after primary power is restored.
3. If the facility is without an emergency generator, the uninterruptible power source shall provide 24 hours of battery backup power.
4. There shall be no equipment malfunctions or perturbations or loss of data during the switch from primary to battery power and vice versa.
5. Batteries shall be sealed, non-outgassing type.
6. Power supply shall be equipped with an indicator for ac input power and an indicator for dc output power.
7. Loss of primary power shall be reported to the central station as an alarm.

C. Auxiliary Equipment Power: A GFI service outlet shall be furnished inside the local processor's enclosure.

D. Entry-Control Local Processor:

1. Entry-control local processor shall respond to interrogations from the field device network, recognize and store alarm status inputs until they are transmitted to the central station, and change outputs based on commands received from the central station.
2. Local processor shall also automatically restore communication within 10 seconds after an interruption with the field device network and provide dc line supervision on each of its alarm inputs.
3. Entry-control local processor shall provide local entry-control functions including communicating with field devices such as card readers, keypads, biometric personnel identity-verification devices, door strikes, magnetic latches, gate and door operators, and exit push buttons.
4. Processor shall also accept data from entry-control field devices as well as database downloads and updates from the central station that include enrollment and privilege information.
5. Processor shall send indications of successful or failed attempts to use entry-control field devices and shall make comparisons of presented information with stored identification information.
6. Processor shall grant or deny entry by sending control signals to portal-control devices and mask intrusion-alarm annunciation from sensors stimulated by authorized entries.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

7. Entry-control local processor shall use inputs from entry-control devices to change modes between access and secure.
8. Local processor shall maintain a date-time- and location-stamped record of each transaction and transmit transaction records to the central station.
9. Processor shall operate as a stand-alone portal controller using the downloaded database during periods of communication loss between the local processor and the central station.
10. Processor shall store a minimum of 4000 transactions during periods of communication loss between the local processor and the central station for subsequent upload to the central station upon restoration of communication.
11. Local processor inputs shall monitor dry contacts for changes of state that reflect alarm conditions.
12. Local processor shall have at least eight alarm inputs which allow wiring contacts as normally open or normally closed for alarm conditions; and shall also provide line supervision for each input by monitoring each input for abnormal open, grounded, or shorted conditions using dc current change measurements.
13. Local processor shall report line supervision alarms to the central station.
14. Alarms shall be reported for any condition that remains abnormal at an input for longer than 500 ms.
15. Alarm condition shall be transmitted to the central station during the next interrogation cycle.
16. Entry-control local processor shall include the necessary software drivers to communicate with entry-control field devices. Information generated by the entry-control field devices shall be accepted by the local processor and automatically processed to determine valid identification of the individual present at the portal.
17. Upon authentication of the credentials or information presented, the local processor shall automatically check privileges of the identified individual, allowing only those actions granted as privileges.
18. Privileges shall include, but are not limited to, time of day control, day of week control, group control, and visitor escort control. The local processor shall maintain a date-time- and location-stamped record of each transaction.
19. Transaction is defined as any successful or unsuccessful attempt to gain access through a controlled portal by the presentation of credentials or other identifying information.
20. Local processor outputs shall reflect the state of commands issued by the central station.
21. Outputs shall be a form C contact and shall include normally open and normally closed contacts.
22. Local processor shall have at least four addressable outputs.
23. The entry-control local processor shall also provide control outputs to portal-control devices.
24. Local processor shall be able to communicate with the central station via RS-485 or TCP/IP as a minimum.
25. The system manufacturer shall provide strategies for downloading database information for panel configurations and cardholder data to minimize the required download time when using IP connectivity.

2.14 REAL-TIME GUARD TOUR

- A. Guard tour module shall provide the ability to plan, track, and route tours. Module shall input an alarm during tour if guard fails to make a station. Tours can be programmed for sequential or random tour-station order.
 1. Guard tour setup shall define specific routes or tours for the guard to take, with time restrictions in which to reach every predefined tour station.
 2. Guard tour activity shall be automatically logged to the central-station workstation's hard drive.
 3. If the guard is early or late to a tour station, a unique alarm per station shall appear at the central station to indicate the time and station.
 4. Guard tour setup shall allow the tours to be executed sequentially or in a random order with an overall time limit set for the entire tour instead of individual times for each tour station.
 5. Setup shall allow recording of predefined responses that will display for the operator at the control station should a "Failed to Check In" alarm occur.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

- B. Guard tour module shall allow proprietary direct-connected systems to use security access-control hardware to perform guard tour management in real time.
- C. A tour station is a physical location where a guard shall go and perform an action indicating that he or she has arrived. This action, performed at the tour station, shall be one of 13 different events with any combination of station types within the same tour. An event at a tour station shall be one of the following types:
 - 1. Access Granted.
 - 2. Access Denied Code.
 - 3. Access Denied Card plus PIN.
 - 4. Access Denied Time Zone.
 - 5. Access Denied Level.
 - 6. Access Denied Facility.
 - 7. Access Denied Code Timer.
 - 8. Access Denied Anti-Passback.
 - 9. Access Granted Passback Violation.
 - 10. Alarm.
 - 11. Restored.
 - 12. Input Normal.
 - 13. Input Abnormal.
- D. Guard tour and other system features shall operate simultaneously with no interference.
- E. Guard Tour Module Capacity: 999 possible guard tour definitions with each tour having up to 99 tour stations. System shall allow all 999 tours to be running at the same time.

2.15 TRANSFORMERS

- A. NFPA 70, Class II control transformers, NRTL listed. Transformers for security access-control system shall not be shared with any other system.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
- B. Examine roughing-in for control cable and conduit systems to network controllers, node controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.
- C. Examine available network capacity and support infrastructure. Consult with network administrator for compliance with network standards and capacity.
- D. Examine install location for compliance with space allocations, installation tolerance, hazards to safe system operation, and other conditions affecting installation.
- E. Examine roughing-in for LAN, WAN, and IP network before device installation.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Comply with recommendations in SIA CP-01.
- B. Comply with TIA 606-B, "Administration Standard for Commercial Telecommunications Infrastructure."
- C. Product Schedules: Obtain detailed product schedules from manufacturer of access-control system or develop product schedules to suit Project. Fill in all data available from Project plans and specifications and publish as Product Schedules for review and approval.
 - 1. Define SMS partitions.
 - 2. Record setup data for network controller.
 - 3. For each Location, record setup of controller features and access requirements.
 - 4. Propose start and stop times for time zones and holidays, and match up access levels for doors.
 - 5. Set up groups, facility codes, linking, and list inputs and outputs for each controller.
 - 6. Assign action message names and compose messages.
 - 7. Set up alarms. Establish interlocks between alarms, intruder detection, and video surveillance features.
 - 8. Prepare and install alarm graphic maps.
 - 9. Develop user-defined fields.
 - 10. Develop screen layout formats.
 - 11. Propose setups for guard tours and key control.
 - 12. Discuss badge layout options; design badges.
 - 13. Complete system diagnostics and operation verification.
 - 14. Prepare a specific plan for system testing, startup, and demonstration.
 - 15. Develop acceptance test concept and, on approval, develop specifics of the test.
 - 16. Develop cable and asset-management system details; input data from construction documents. Include system schematics and Technical Drawings in electronic format.
- D. In meetings with Engineer and Owner, present Product Schedules and review, adjust, and prepare final setup documents. Use approved, final Product Schedules to set up system software.

3.03 IDENTIFICATION

- A. In addition to requirements in this article, comply with applicable requirements in Section 270553 "Identification for Communications Systems" and with TIA 606-B.
- B. Using software specified in "Cable and Asset Management Software" Article, develop cable administration drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with the same designation. Use logical and systematic designations for facility's architectural arrangement.
- C. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - 1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

- D. At completion, cable and asset management software shall reflect as-built conditions.

3.04 SYSTEM SOFTWARE AND HARDWARE

- A. Develop, install, and test software and hardware, and perform database tests for the complete and proper operation of systems involved. Assign software license to Owner.
- B. Assign the software license(s) to Owner.
- C. All default passwords shall be changed to those selected by the Owner.
 - 1. The contractor shall retain no records of passwords for the project.

3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Inspection: Confirm that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
 - 2. Pretesting: Configure and pretest system components, wiring, and functions to confirm that they comply with specified requirements.
 - 3. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements.
 - 4. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
 - 5. Operational Tests: Perform operational system tests to confirm that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.
- C. The system is considered defective and the project incomplete if it does not pass tests and inspections
- D. Prepare test and inspection reports.

3.06 STARTUP SERVICE

- A. Engage a factory-authorized service representative to supervise and assist with startup service.
 - 1. Complete installation and startup checks according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.
 - 2. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel.

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT (continued):

3.07 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Tasks shall include, but are not limited to, the following:
1. Check cable connections.
 2. Confirm system configuration and adjust settings needed.
 3. Recommend changes to system to improve Owner's use of video surveillance system.
 4. Provide a written report of adjustments and recommendations.

3.08 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain security access system. See Division 01 "Demonstration and Training."
- B. Develop separate training modules for the following:
1. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.
 2. Operators who prepare and input credentials to man the network-connected PC with a browser and to enroll personnel.
 3. Security personnel.
 4. Hardware maintenance personnel.
 5. Corporate management.

END OF SECTION 281300

SECTION 281500 - ACCESS CONTROL HARDWARE DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Proximity card readers, credential cards, and keypads
 - 2. Cables
 - 3. Transformers

1.03 DEFINITIONS

- A. Credential: Data assigned to an entity and used to identify that entity.
- B. DTS: Digital Termination Service. A microwave-based, line-of-sight communication provided directly to the end user.
- C. Identifier: A credential card; keypad personal identification number; or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.
- D. Location: A Location on the TCP/IP network having a network-to-node controller communications link. Where this term is presented with an initial capital letter, this definition applies.
- E. Network Controller: Top tier of network-enabled architecture connected by a TCP/IP network and manageable from any network-connected PC with a browser.
- F. Node Controller: Field-installed controller at each Location connected to the system's inputs, outputs, and readers that manages access control decisions with data provided by the Network Controller.
- G. PC: Personal computer. Applies to the central station, workstations, and file servers.
- H. RAS: Remote access services.
- I. RF: Radio frequency.
- J. ROM: Read-only memory. ROM data are maintained through losses of power.
- K. TCP/IP: Transport control protocol/Internet protocol.
- L. TWAIN: Technology without an Interesting Name. A programming interface that lets a graphics application, such as an image editing program or desktop publishing program, activate a scanner, frame grabber, or other image-capturing device.

SECTION 281500 - ACCESS CONTROL HARDWARE DEVICES (continued):

- M. WMP: Windows media player.
- N. Wiegand: Patented magnetic principle that uses specially treated wires embedded in the credential card.
- O. WYSIWYG: What You See Is What You Get. Text and graphics appear on the screen the same as they will in print.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Reference each product to a location on Drawings. Test and evaluation data presented in Product Data shall comply with SIA BIO-01.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 "Operation and Maintenance Data" and Section 280100 "General Provisions for Electronic Safety and Security", include the following:
 - 1. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on USB media of the hard-copy submittal.
 - 2. System installation and setup guides with data forms to plan and record options and setup decisions.

1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Credential card blanks, ready for printing. Include enough credential cards for all personnel to be enrolled at the site plus an extra 50 percent for future use.
 - 2. Sticker tag blanks, ready for printing. Include enough sticker cards for all personnel to be enrolled at the site plus an extra 50 percent for future use.
 - 3. Fuses of all kinds, power and electronic, equal to 10 percent of amount installed for each size used, but no fewer than three units.
 - 4. .

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 - 1. Cable installer must have on staff an RCDD certified by Building Industry Consulting Service International.
- B. Source Limitations: Obtain central station, workstations, controllers, Identifier readers, and all software through one source from single manufacturer.

SECTION 281500 - ACCESS CONTROL HARDWARE DEVICES (continued):

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store in temperature- and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 deg F (10 and 30 deg C), and not more than 80 percent relative humidity, noncondensing.
- B. Open each container; verify contents against packing list; and file copy of packing list, complete with container identification, for inclusion in operation and maintenance data.
- C. Mark packing list with the same designations assigned to materials and equipment for recording in the system labeling schedules that are generated by software specified in "Cable and Asset Management Software" Article.
- D. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.09 PROJECT CONDITIONS

- A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - 1. Control Station: Rated for continuous operation in ambient conditions of 60 to 85 deg F (16 to 30 deg C) and a relative humidity of 20 to 80 percent, noncondensing.
 - 2. Indoor, Controlled Environment: NEMA 250, Type 1 enclosure. System components, except the central-station control unit, installed in temperature-controlled indoor environments shall be rated for continuous operation in ambient conditions of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
 - 3. Indoor, Uncontrolled Environment: NEMA 250, Type 12 enclosures. System components installed in non-temperature-controlled indoor environments shall be rated for continuous operation in ambient conditions of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
 - 4. Outdoor Environment: NEMA 250, NEMA 250, Type 3R or Type 4 enclosures. System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation where exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h).
 - 5. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
 - 6. Corrosive Environment: For system components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X enclosures.

PART 2 - PRODUCTS

2.01 OPERATION

- A. Security access system hardware shall use a single database for access-control and credential-creation functions.

SECTION 281500 - ACCESS CONTROL HARDWARE DEVICES (continued):

2.02 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70, "National Electrical Code."

2.03 PROXIMITY CARD READERS, CREDENTIAL CARDS AND FOBS, AND KEYPADS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Allegion; Multi-Technology Readers
 - 2. Honeywell: OmniProx.
 - 3. HID; Proximity Card Readers
- B. Card-Reader Power: Powered from its associated controller, including its standby power source, and shall not dissipate more than 5 W.
- C. Response Time: Card reader shall respond to passage requests by generating a signal that is sent to the controller. Response time shall be 800 ms or less, from the time the card reader finishes reading the credential card until a response signal is generated.
- D. Enclosure: Suitable for surface, semi-flush, pedestal, or weatherproof mounting. Mounting types shall additionally be suitable for installation in the following locations:
 - 1. Indoors, controlled environment.
 - 2. Indoors, uncontrolled environment.
 - 3. Outdoors, with built-in heaters or other cold-weather equipment to extend the operating temperature range as needed for operation at the site.
- E. Display: Digital visual indicator shall provide visible and audible] status indications and user prompts. Indicate power on or off, whether user passage requests have been accepted or rejected, and whether the door is locked or unlocked.
- F. Touch-Plate and Proximity Readers:
 - 1. Active-detection proximity card readers shall provide power to compatible credential cards through magnetic induction, and shall receive and decode a unique identification code number transmitted from the credential card.
 - 2. The card reader shall read proximity cards in a range from direct contact to at least 6 inches (150 mm) from the reader.
- G. Keypad and Proximity Reader Combination: Designed to require an entry on the keypad before presenting the credential card.
 - 1. Keypad: Allow the entry of four numeric digits that are associated with a specific credential. Keypads shall contain an integral alphanumeric/special symbol keyboard with symbols arranged in ascending ASCII-code ordinal sequence. Keypad display or enclosure shall limit viewing angles of the keypad as follows:
 - a. Maximum Horizontal Viewing Angle: Plus or minus 5 degrees or less off a vertical plane perpendicular to the plane of the face of the keypad display.
 - b. Maximum Vertical Viewing Angle: Plus or minus 15 degrees or less off a horizontal plane perpendicular to the plane of the face of the keypad display.

SECTION 281500 - ACCESS CONTROL HARDWARE DEVICES (continued):

2. Keypads shall provide a means for users to indicate a duress situation by entering a special code.
- H. Communication Protocol: Compatible with local processor.
- I. Touch-Plate and Contactless Card Reader: The reader shall have "flash" download capability to accommodate card format changes. The card reader shall have capability of transmitting data to security control panel and shall comply with ISO/IEC 7816.
- J. Credentials: Proximity card technology with photo identification capability on a single access control card.
 1. Card Size and Dimensional Stability: Credential cards shall be 2-1/8 by 3-3/8 inches (54 by 86 mm). The credential card material shall be dimensionally stable so that an undamaged card with deformations resulting from normal use shall be readable by the card reader.
 2. Card Material: Abrasion resistant, nonflammable, nontoxic, and impervious to solar radiation and effects of ultraviolet light.
 3. Card Construction:
 - a. Core and laminate or monolithic construction.
 - b. Lettering, logos, and other markings shall be hot stamped into the credential material or direct printed.
 - c. Furnish equipment for on-site assembly and lamination of credential cards.

2.04 CABLES

- A. General Cable Requirements: Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and as recommended by system manufacturer for integration requirement.
- B. Plenum-Rated TIA 232-F Cables:
 1. Three, No. 22 AWG, stranded (7x30) tinned copper conductors.
 2. PE insulation.
 3. Aluminum foil-polyester tape shield with 100 percent shield coverage.
 4. Fluorinated ethylene propylene jacket.
 5. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 6. Flame Resistance: Comply with NFPA 262.
- C. Plenum-Rated TIA 485-A Cables:
 1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 2. Fluorinated ethylene propylene insulation.
 3. Unshielded.
 4. Fluorinated ethylene propylene jacket.
 5. NFPA 70 Type: Type CMP
 6. Flame Resistance: NFPA 262, Flame Test.
- D. Paired, Plenum-Type, Reader and Wiegand Keypad Cables:
 1. Three pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, plastic insulation, individual aluminum-foil/polypropylene-tape shielded pairs each with No. 22 AWG, stranded tinned copper drain wire, 100 percent shield coverage, and fluorinated-ethylene-propylene jacket.
 2. NFPA 70, Type CMP.
 3. Flame Resistance: NFPA 262 flame test.

SECTION 281500 - ACCESS CONTROL HARDWARE DEVICES (continued):

E. Multiconductor, Plenum-Type, Reader and Wiegand Keypad Cables:

1. Six conductors, No. 20 AWG, stranded (7x28) tinned copper conductors, fluorinated-ethylene-propylene insulation, overall aluminum-foil/polyester-tape shield with 100 percent shield coverage plus tinned copper braid shield with 85 percent shield coverage, and fluorinated-ethylene-propylene jacket.
2. NFPA 70, Type CMP.
3. Flame Resistance: NFPA 262 flame test.

F. LAN Cabling:

1. Comply with requirements in Section 271513 "Communications Copper Horizontal Cabling."

2.05 TRANSFORMERS

- A. NFPA 70, Class II control transformers, NRTL listed. Transformers for security access-control system shall not be shared with any other system.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
- B. Examine roughing-in for LAN and control cable conduit systems to PCs, controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Comply with recommendations in SIA CP-01.
- B. Comply with TIA 606-B, "Administration Standard for Commercial Telecommunications Infrastructure."
- C. Product Schedules: Obtain detailed product schedules from manufacturer of access-control system or develop product schedules to suit Project. Fill in all data available from Project plans and specifications and publish as Product Schedules for review and approval.
- D. In meetings with Architect and Owner, present Product Schedules and review, adjust, and prepare final setup documents. Use approved, final Product Schedules to set up system software.

3.03 CABLING

- A. See "Responsibility Matrix for Technology and Electronic Safety" on Drawings for requirements of pathways and wiring.

SECTION 281500 - ACCESS CONTROL HARDWARE DEVICES (continued):

- B. Comply with NECA 1, "Good Workmanship in Electrical Construction."
- C. Install cables and wiring according to requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- D. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.
- E. Install LAN cables using techniques, practices, and methods that are consistent with Category 5e rating of components and optical fiber rating of components, and that ensure Category 6 and optical fiber performance of completed and linked signal paths, end to end.
- F. Boxes and enclosures containing security-system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.
- G. Install end-of-line resistors at the field device location and not at the controller or panel location.

3.04 CABLE APPLICATION

- A. Comply with TIA 569-D, "Commercial Building Standard for Telecommunications Pathways and Spaces."
- B. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.
- C. TIA 232-F Cabling: Install at a maximum distance of 50 ft. (15 m) between terminations.
- D. TIA 485-A Cabling: Install at a maximum distance of 4000 ft. (1220 m) between terminations.
- E. Proximity Card Readers and Keypads:
 - 1. Install number of conductor pairs recommended by manufacturer for the functions specified.
 - 2. Unless manufacturer recommends larger conductors, install No. 22 AWG wire if maximum distance from controller to the reader is 250 ft. (75 m), and install No. 20 AWG wire if maximum distance is 500 ft. (150 m).
 - 3. For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the controller.
 - 4. Install minimum No. 18 AWG shielded cable to readers and keypads that draw 50 mA or more.
- F. Install minimum No. 16 AWG cable from controller to electrically powered locks. Do not exceed 250 ft. (75 m) between terminations.
- G. Install minimum No. 18 AWG ac power wire from transformer to controller, with a maximum distance of 25 ft. (8 m) between terminations.

3.05 GROUNDING

- A. Comply with Section 270526 "Grounding and Bonding for Communications Systems."
- B. Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."

SECTION 281500 - ACCESS CONTROL HARDWARE DEVICES (continued):

- C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- D. Bond shields and drain conductors to ground at only one point in each circuit.
- E. Signal Ground:
 - 1. Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
 - 2. Bus: Mount on wall of main equipment room with standoff insulators.
 - 3. Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

3.06 INSTALLATION

- A. Install card readers, and keypads.

3.07 IDENTIFICATION

- A. In addition to requirements in this article, comply with applicable requirements in Section 270553 "Identification for Communications Systems" and with TIA 606-B.
- B. Using software specified in "Cable and Asset Management Software" Article, develop cable administration drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with the same designation. Use logical and systematic designations for facility's architectural arrangement.
- C. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - 1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.
- D. At completion, cable and asset management software shall reflect as-built conditions.

3.08 SYSTEM SOFTWARE AND HARDWARE

- A. Develop, install, and test software and hardware, and perform database tests for the complete and proper operation of systems involved. Assign software license to Owner.

3.09 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

SECTION 281500 - ACCESS CONTROL HARDWARE DEVICES (continued):

B. Tests and Inspections:

1. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use tester approved for type and kind of installed cable. Test for faulty connectors, splices, and terminations. Test according to TIA 568-C.1, "Commercial Building Telecommunications Cabling Standards - Part 1: General Requirements." Link performance for balanced twisted-pair cables must comply with minimum criteria in TIA 568-C.1.
2. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power-supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.
3. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

C. Devices and circuits will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.10 STARTUP SERVICE

A. Engage a factory-authorized service representative to supervise and assist with startup service.

1. Complete installation and startup checks according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.
2. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel.

3.11 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain security access system. See Division 01 "Demonstration Training" and Section 280100 "General Provisions for Electronic Safety and Security".

B. Develop separate training modules for the following:

1. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.
2. Operators who prepare and input credentials to man the control station and workstations and to enroll personnel.
3. Security personnel.
4. Hardware maintenance personnel.
5. Corporate management.

END OF SECTION 281500

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SECTION 282300 - VIDEO SURVEILLANCE CONTROL AND MANAGEMENT SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes a video surveillance system consisting of cameras, digital video recorder, data transmission wiring, and a control station with its associated equipment.
- B. Related Requirements:
 - 1. Section 281300 "Access Control System Software and Database Management" to integrate access control system interface and control.
 - 2. Section 282500 "Surveillance Devices" to integrate video and audio surveillance devices.
 - 3. Section 283100 "Intrusion Detection" to integrate video surveillance used for intrusion detection.

1.03 DEFINITIONS

- A. API: Application Programming Interface
- B. AVI: Audio Video Interleave
- C. FTP: File transfer protocol.
- D. IP: Internet protocol.
- E. LAN: Local area network.
- F. MPEG: Moving picture experts group.
- G. NTSC: National Television System Committee.
- H. NVR: Network Video Recorder
- I. PC: Personal computer.
- J. PTZ: Pan-tilt-zoom.
- K. RAID: Redundant array of independent disks.
- L. RAM: Random Access Memory
- M. SMS: Security Management System
- N. TCP: Transmission control protocol - connects hosts on the Internet.

SECTION 282300 - VIDEO SURVEILLANCE CONTROL AND MANAGEMENT SYSTEMS (continued):

- O. UPS: Uninterruptible power supply.
- P. USB: Universal Serial Bus
- Q. VMS: Video Management System
- R. WAN: Wide area network.
- S. WDR: Wide Dynamic Range

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, software versions, operating system details, and finishes.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types, quantities, and sizes.
 - 3. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.
 - 4. UPS: Sizing calculations.
 - 5. Wiring Diagrams: For power, signal, and control wiring.
 - 6. Data Calculations: Provide VMS bandwidth and storage calculations meeting minimum project requirements as described herein.
 - 7. System integration plans.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For cameras, audio interfaces, and infrared illuminators, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 "Operation and Maintenance Data" and in Section 280100 "General Provisions for Electronic Safety and Security," include the following:
 - 1. Lists of spare parts and replacement components recommended to be stored at the site for ready access.

1.06 PROJECT CONDITIONS

- A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - 1. Interior, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient temperatures of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 1 enclosures.

1.07 QUALITY ASSURANCE

- A. Installation shall comply with federal, state, and local codes and authorities having jurisdiction (AHJ).

SECTION 282300 - VIDEO SURVEILLANCE CONTROL AND MANAGEMENT SYSTEMS (continued):

- B. All software and hardware shall be programmed and installed in accordance with manufacturer's specifications.
- C. All equipment shall be new, in current production, and the standard products of a manufacturer of ESS equipment.
- D. The manufacturer shall guarantee availability of parts, for a minimum of seven (7) years from date of shipment.
- E. On-site maintenance and repair service shall be available locally and within four (4) hours of notification of condition.
- F. Software integration between all integrated systems shall be tested and certified for interoperability by the manufacturer of each system.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Approved Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ExacqVision: Enterprise VMS
 - 2. Genetec: Omnicast
 - 3. Hanwha Techwin: Wisenet WAVE
 - 4. Honeywell: ProWatch
 - 5. Lenel S2: VRx Enterprise
 - 6. Avigilon: Control Center

2.02 SYSTEM REQUIREMENTS

- A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor's entry connection to components.
 - 1. Minimum Protection for Power Connections 120 V and More: Auxiliary panel suppressors complying with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."
 - 2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits" as recommended by manufacturer for type of line being protected.
- B. Tamper Protection: Tamper switches on enclosures, control units, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled.

SECTION 282300 - VIDEO SURVEILLANCE CONTROL AND MANAGEMENT SYSTEMS (continued):

2.03 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NECA 1.
- C. Comply with NFPA 70.
- D. Electronic data exchange between video surveillance system with an access-control system shall comply with SIA TVAC.

2.04 VIDEO MANAGEMENT SYSTEM

- A. Description:
 - 1. The VMS shall be a software package for comprehensive management of live and recorded IP-based video, and associated audio and control data using standard Ethernet-based networks.
 - 2. The VMS shall have seamless integration of all video surveillance and control functions.
 - 3. Graphical user interface software shall manage all IP-based video matrix switching and camera control functions, two-way audio communication, alarm monitoring and control, and recording and archive/retrieval management. IP system shall also be capable of integrating into larger system environments.
 - 4. System design shall include all necessary compression software for high-performance, dual-stream, MPEG-2/MPEG-4 video. Unit shall provide connections for all video cameras, camera PTZ control data, bidirectional audio, discreet sensor inputs, and control system outputs.
 - 5. All camera signals shall be compressed, encoded, and delivered onto the network for processing and control by the IP video-management software.
- B. General Functionality:
 - 1. Provide effective monitoring of video from IP cameras and encoding devices, two-way audio and data in real time over local and wide area networks.
 - 2. Interactive and multi-level mapping.
 - 3. Data integration from retail and access control systems.
 - 4. Single-screen administration across multiple servers and systems, including:
 - a. Global configuration and monitoring of camera, encoder, and storage settings across the enterprise.
 - b. Administration of all users on multiple servers.
 - c. E-mail and text (SMS) notifications.
 - 5. Automatic identification and IP address assignment of compatible IP cameras and encoders with status display.
 - a. The option to enable an embedded DHCP server to assign camera addresses via DHCP.
 - 6. Open architecture supporting IP cameras and encoders and access control systems from multiple manufacturers.
 - 7. Available client software to allow remote access to live and recorded video, including access from mobile devices.
 - a. Support simultaneous access to video from multiple servers.
 - 8. Virtual matrix functionality.
 - 9. Provisioned as a service without requiring any application to be running in order to operate.
 - 10. 2-way audio support between server, client, and camera.
- C. Architecture
 - 1. The VMS shall have a client/server-based architecture that can be configured as a standalone VMS with the client software running with equal functionality on the server hardware and/or the client running on any network-connected TCP/IP workstation.

SECTION 282300 - VIDEO SURVEILLANCE CONTROL AND MANAGEMENT SYSTEMS (continued):

2. User Interfaces – The VMS shall support installed client and web client interfaces.
 - a. The VMS shall record and retrieve video, audio and alarm data and provide it to the VMS clients upon request.
 - b. Installed client characteristics:
 - 1) Downloadable at no charge from the Manufacturer's web site.
 - 2) Fully compatibility with all available features of the VMS server software.
 - 3) View live video and audio, recorded video and audio and be able to configure the complete system all from a single application.
 - 4) Add and remove features based on the permissions of the user and the licensed functionality.
 - c. PC Web Client - The web client interface shall operate without requiring installation of any software.
 - 1) Functions:
 - a) View live video.
 - b) View recorded video.
 - c) Control pan-tilt zoom (PTZ) cameras.
 - d) Activate triggers
 - e) Allow connections to multiple VMS servers simultaneously
 - 2) The VMS server shall be able to transcode video into a JPEG file sized for compatibility with the browser screen before sending it to the client browser.
 - 3) The web client shall be capable of decoding JPEG and H.264 and H.265 video streams.
 - d. The VMS software shall allow the user to have any combination of VMS client applications running on any of the supported operating systems and be able to connect to any of the VMS servers running on any of the supported operating systems.
 - 1) Multiple client workstations shall be capable of simultaneously viewing live and/or recorded video from one or more servers.
 - e. The VMS software shall have the capability to run multiple client applications simultaneously on one workstation with multiple monitors.
 - 1) Up to 12 monitors shall be configurable on a single workstation with one (1) client application running on each monitor.
 - f. Multiple servers shall be able to simultaneously provide live and/or recorded video to one or more workstations.
 - g. The VMS server software shall have the ability to be installed on an IP edge device, such as an IP camera or encoder that allows for third-party applications, allowing the device to serve as both a server and IP video recording device.

D. Compatibility / Integration: The VMS shall be compatible with the provided access control system for system integration.

E. Server Requirements:

1. Operating System: Microsoft Windows
2. Network Interface: 1000BASE-T Ethernet

F. Acceptable Web Browsers:

1. PC: Internet Explorer, Firefox, Safari, Opera, Chrome, all non-JavaScript browsers.
2. HTML Compliance: HTML 4.0

2.05 NETWORK VIDEO RECORDERS

- A. Description: The Network Video Recorder (NVR) supports simultaneous recording, remote viewing and search, and system management for IP cameras including high-definition formats. Multiple NVRs may be deployed for system expansion using a distributed architecture and integrated with the multi-site software or enterprise video management system.

SECTION 282300 - VIDEO SURVEILLANCE CONTROL AND MANAGEMENT SYSTEMS (continued):

- B. Components:
 - 1. NVR Server: Contains the recording engine, database of all network-connected cameras and encoders, integrated components and their configurations. Server shall be provided as a combined hardware and software device.
- C. Hardware: NVR Server shall operate with no performance degradation using the following minimum hardware.
 - 1. Rackmount, 2U or 4U with multiple hard drives.
 - 2. Memory: 8 GB RAM.
 - 3. Power Supplies: Dual redundant.
 - 4. Operating System Drives: RAID 1 support.
 - 5. Storage Capacities:
 - a. Provide storage capacity calculated at 25 FPS per camera for 14 days with 20% spare capacity allowance.
 - b. Video storage redundancy with RAID 5 support.
 - 6. Video Storage Hard Drives: Multiple field-upgradable.
 - 7. Network Interface: Dual 1 GB Ethernet.
 - 8. Supported Devices: Capable of supporting all IP cameras with 20% spare IP inputs.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerance, hazards to camera installation, and other conditions affecting installation.
- B. Examine available network capacity and support infrastructure. Consult with network administrator for compliance with network standards and capacity
- C. Examine install location for compliance with space allocations, installation tolerance, hazards to safe system operation, and other conditions affecting installation
- D. Examine roughing-in for LAN, WAN, and IP network before device installation.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Prior to beginning system programming, prepare detailed project planning forms for programming and configuration of the system. Fill in all data available from project plans and specifications and publish as project planning documents for review and approval. These may include (but are not limited to):
 - 1. Define user (operator) types.
 - 2. Define camera naming schema.
 - 3. Determine storage requirements.
 - 4. Determine FPS requirements.
 - 5. Determine motion recording.
 - 6. Define event programming
 - 7. Develop matrix layouts
 - 8. Prepare a project specific plan for system testing, startup, and demonstration
 - 9. Develop cable and asset-management system labeling plan

SECTION 282300 - VIDEO SURVEILLANCE CONTROL AND MANAGEMENT SYSTEMS (continued):

- B. In meetings with Owner, present Project planning documents and review, adjust, and prepare final programming and configuration documents. Use final documents to program and configure software.

3.03 SYSTEM SOFTWARE AND HARDWARE

- A. Develop, install, and test software and hardware, and perform tests for the complete and proper operation of systems involved.
- B. Assign the software license(s) to Owner.
- C. All default passwords shall be changed to those selected by the Owner.
 - 1. The contractor shall retain no records of passwords for the project.

3.04 VIDEO SURVEILLANCE SYSTEM INSTALLATION

- A. Identify system components, wiring, cabling, and terminals according to Section 270553 "Identification for Communications Systems."

3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
 - 2. Pretesting: Configure and pretest VMS components, wiring, and functions to confirm that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as follows:
 - a. Prepare equipment list
 - b. Confirm operation of all camera streams and check data storage configuration.
 - c. Confirm operation of all third-party integrated components and systems
 - d. Set and name all camera streams and preset positions; consult Owner's personnel.
 - e. Confirm operation of monitoring equipment.
 - 3. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
 - 4. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.
- D. Video surveillance system will be considered defective if it does not pass tests and inspections.

SECTION 282300 - VIDEO SURVEILLANCE CONTROL AND MANAGEMENT SYSTEMS (continued):

- E. Prepare test and inspection reports.

3.06 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Tasks shall include, but are not limited to, the following:
 - 1. Check cable connections.
 - 2. Check proper operation of camera streams and storage retention.
 - 3. Confirm system configuration and adjust settings needed.
 - 4. Recommend changes to system to improve Owner's use of video surveillance system.
 - 5. Provide a written report of adjustments and recommendations.

3.07 CLEANING

- A. Clean installed items using methods and materials recommended in writing by manufacturer.
- B. Clean video-surveillance-system components, including camera-housing windows, lenses, and monitor screens.

3.08 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain video-surveillance equipment.

END OF SECTION 282300

SECTION 282500 - SURVEILLANCE DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes a video surveillance system consisting of cameras, digital video recorder, data transmission wiring, and a control station with its associated equipment.
- B. Related Requirements:
 - 1. Section 281300 "Access Control System Software and Database Management" to integrate access control system interface and control.
 - 2. Section 282300 "Video Surveillance Control and Management Systems" for control and monitoring applications, workstations, and interfaces.
 - 3. Section 283100 "Intrusion Detection" to integrate video surveillance used for intrusion detection.

1.03 DEFINITIONS

- A. AGC: Automatic gain control.
- B. BNC: Bayonet Neill-Concelman - type of connector.
- C. B/W: Black and white.
- D. CCD: Charge-coupled device.
- E. FTP: File transfer protocol.
- F. IP: Internet protocol.
- G. LAN: Local area network.
- H. MPEG: Moving picture experts group.
- I. NTSC: National Television System Committee.
- J. PC: Personal computer.
- K. PTZ: Pan-tilt-zoom.
- L. TCP: Transmission control protocol - connects hosts on the Internet.
- M. UPS: Uninterruptible power supply.

SECTION 282500 - SURVEILLANCE DEVICES (continued):

- N. WAN: Wide area network.
- O. WDR: Wide Dynamic Range

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For video surveillance. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.
 - 3. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.
 - 4. UPS: Sizing calculations.
 - 5. Wiring Diagrams: For power, signal, and control wiring.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For cameras, audio interfaces, and infrared illuminators, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 "Operation and Maintenance Data" and in Section 280100 "General Provisions for Electronic Safety and Security," include the following:
 - 1. Lists of spare parts and replacement components recommended to be stored at the site for ready access.

1.06 PROJECT CONDITIONS

- A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - 1. Control Station: Rated for continuous operation in ambient temperatures of 60 to 85 deg F (16 to 29 deg C) and a relative humidity of 20 to 80 percent, noncondensing.
 - 2. Interior, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient temperatures of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 1 enclosures.
 - 3. Interior, Uncontrolled Environment: System components installed in non- temperature-controlled interior environments shall be rated for continuous operation in ambient temperatures of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 12 enclosures.
 - 4. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h). Use NEMA 250, Type 3R or Type 4 enclosures.

SECTION 282500 - SURVEILLANCE DEVICES (continued):

5. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
6. Corrosive Environment: System components subject to corrosive fumes, vapors, and wind-driven salt spray in coastal zones. Use NEMA 250, Type 4X enclosures.
7. Security Environment: Camera housing for use in high-risk areas where surveillance equipment may be subject to physical violence.

1.07 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SYSTEM REQUIREMENTS

- A. Video-signal format shall comply with NTSC standard, composite interlaced video. Composite video-signal termination shall be 75 ohms.
- B. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor's entry connection to components.
 1. Minimum Protection for Power Connections 120 V and More: Auxiliary panel suppressors complying with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."
 2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits" as recommended by manufacturer for type of line being protected.
- C. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station, control-unit alarm display shall identify tamper alarms and indicate locations.

2.02 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NECA 1.
- C. Comply with NFPA 70.
- D. Electronic data exchange between video surveillance system with an access-control system shall comply with SIA TVAC.

SECTION 282500 - SURVEILLANCE DEVICES (continued):

2.03 NETWORK (IP) CAMERAS

- A. **Basis-of-Design Product:** Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Axis Communications.
 2. **Bosch Security Systems, Inc.**
 3. Hanwha Techwin.
 4. Panasonic (iPro).
 5. Univision.
- B. Casing:
1. Vandal Protection (where indicated on schedules): IK08.
 2. Dustproof.
 3. Waterproof (where indicated on schedules).
- C. Camera:
1. Imager: Progressive scan RGB CMOS.
 2. Lens: Fixed or varifocal. (See schedules for lens type and angle of view.)
 3. Integral infrared illumination.
 4. Sensitivity: Camera shall provide usable images in low-light conditions, delivering an image at a scene illumination of 0.20 lux at 50 IRE.
- D. Video:
1. Compression and Transmission: H.265, H2.64, and MJPEG compression, each derived from a dedicated encoder and capable of being streamed independently and simultaneously.
 2. Resolution: See schedules.
 3. Frame Rate: See schedules.
 4. Digital Pan/Tilt/Zoom: See schedules.
 5. Image Settings / Features:
 - a. Day / night settings
 - b. Backlight compensation (BLC)
 - c. Wide dynamic resolution (WDR)
 - d. Motion detection
 - e. Privacy masking
 - f. White balance
 - g. Exposure control (including automatic gain control)
 - h. Image mirror
 - i. Image flip
 - j. Rotation: 0°, 90°, 180°, 270°, including corridor formatting
 6. Storage:
 - a. RAM: 512 MB.
 - b. Onboard SD card.
 - c. Network Attached Storage (NAS).
- E. Audio: Where required per schedule, provide two-way audio with built-in omnidirectional microphone. Two-way audio shall be provided by either:
1. Integral to camera.
 2. External audio interface with input/output ports for remote mounting.
 - a. Electrical: Power over Ethernet (PoE), IEEE 802.3af/802.3at Type 1, Class 2 or 3.
 - b. Provide single stream for audio and video.
- F. Network:

SECTION 282500 - SURVEILLANCE DEVICES (continued):

1. Connectivity: 10/100 Base-T Ethernet via RJ-45 connector.
 2. Security:
 - a. Password protection
 - b. IP address filtering
 - c. HTTPS (SSL) encryption
 - d. Digest login authentication
 - e. User access log
 - f. IEEE 802.1x authentication
 3. Supported protocols
 - a. Transmission Control Protocol (TCP), Internet Protocol (IP) v4 and v6, User Datagram Protocol (UDP)
 - b. Configuration: Dynamic Host Configuration Protocol (DHCP)
 - c. Web services: Hypertext Transfer Protocol (HTTP), Secure HTTP (HTTPS)
 - d. Network services: Address Resolution Protocol (ARP), Bonjour, Domain Name System (DNS), Internet Control Message Protocol (ICMP), Network Time Protocol (NTP), Protocol Independent Multicast-Sparse Mode (PIM-SM), Simple Network Management Protocol (SNMP v1/2c/3 – MIB-2), Universal Plug and Play (UPnP)
 - e. Media: Real-Time Transport Protocol (RTP), Real-Time Control Protocol (RTCP), Real-Time Streaming Protocol (RTSP)
 - f. Multicast: Internet Group Management Protocol (IGMP)
 - g. Notifications: File Transfer Protocol (FTP), Simple Mail Transfer Protocol (SMTP)
- G. Electrical: Power over Ethernet (PoE), IEEE 802.3af/802.3at Type 1, Class 1 or 3.
- H. Software:
1. Built-in web server which supports browser-based configuration using Internet Explorer, Google Chrome, Mozilla Firefox, and Apple Safari from a PC or Mac.
 2. Monitoring screen which displays live video and simultaneously provides same-screen access for the following functions:
 - a. Live view window size
 - b. Resolution setting
 - c. Image (snapshot) capture
 - d. Manual recording to SD or NAS
 - e. Audio/microphone control
 - f. Access recorded data playback and camera configuration menus
 - g. Digital PTZ
 3. Playback screen which provides the following functions:
 - a. Recorded data search using date and time range
 - b. Recorded data search using event type
 - c. Play a recorded video by event triggering
 - d. Set resolution
 - e. Play audio if present
 - f. Generate a backup copy of saved video data
 4. Setup screen which provides access to configuration settings and functions in the camera.

2.04 CAMERA-SUPPORTING EQUIPMENT

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
1. Axis Communications.
 2. Bosch Security Systems, Inc.

SECTION 282500 - SURVEILLANCE DEVICES (continued):

3. Hanwha Techwin.
 4. Pelco.
 5. Panasonic (iPro).
 6. Univision
 7. Tyco Security Products; Johnson Controls.
- B. Minimum Load Rating: Rated for load in excess of the total weight supported times a minimum safety factor of two.
- C. Mounting Brackets for Fixed Cameras: Type matched to items supported and mounting conditions. Include manual pan-and-tilt adjustment.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerance, hazards to camera installation, and other conditions affecting installation.
- B. Examine roughing-in for LAN, WAN, and IP network before device installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 WIRING

- A. See "Responsibility Matrix for Technology and Electronic Safety" on Drawings for requirements of pathways and wiring.
- B. Comply with requirements in Section 270528 "Pathways for Communications Systems."
- C. Wiring Method: Install cables in raceways unless otherwise indicated.
1. Except raceways are not required in accessible indoor ceiling spaces and attics.
 2. Except raceways are not required in hollow gypsum board partitions.
 3. Conceal raceways and wiring except in unfinished spaces.
- D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- E. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- F. For communication wiring, comply with the following:
1. Section 271313 "Communications Copper Backbone Cabling."
 2. Section 271323 "Communications Optical Fiber Backbone Cabling."
 3. Section 271513 "Communications Copper Horizontal Cabling."
 4. Section 271523 "Communications Optical Fiber Horizontal Cabling."

SECTION 282500 - SURVEILLANCE DEVICES (continued):

5. 271533"CommunicationsCoaxialHorizontalCabling."

G. Grounding: Provide independent-signal circuit grounding recommended in writing by manufacturer.

3.03 VIDEO SURVEILLANCE SYSTEM INSTALLATION

A. Install cameras and infrared illuminators level and plumb.

B. Install cameras with ~~84-inch-~~ (2134-mm-) minimum clear space below cameras and their mountings. Change type of mounting to achieve required clearance.

C. Set pan unit and pan-and-tilt unit stops to suit final camera position and to obtain the field of view required for camera. Connect all controls and alarms, and adjust.

D. Install power supplies and other auxiliary components at control stations unless otherwise indicated.

E. Install tamper switches on components indicated to receive tamper switches, arranged to detect unauthorized entry into system-component enclosures and mounted in self-protected, inconspicuous positions.

F. Avoid ground loops by making ground connections only at the control station.

1. For 12- and 24-V dc cameras, connect the coaxial cable shields only at the monitor end.

G. Identify system components, wiring, cabling, and terminals according to Section 270553 "Identification for Communications Systems."

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.

2. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as follows:

a. Prepare equipment list described in "Informational Submittals" Article.

b. Verify operation of auto-iris lenses.

c. Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.

d. Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object ~~50 to 75 feet~~ (17 to

SECTION 282500 - SURVEILLANCE DEVICES (continued):

23 m) away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.

- e. Set and name all preset positions; consult Owner's personnel.
 - f. Set sensitivity of motion detection.
 - g. Connect and verify responses to alarms.
 - h. Verify operation of control-station equipment.
- 3. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
 - 4. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.
- C. Video surveillance system will be considered defective if it does not pass tests and inspections.
 - D. Prepare test and inspection reports.

3.05 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Tasks shall include, but are not limited to, the following:
 - 1. Check cable connections.
 - 2. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.
 - 3. Adjust all preset positions; consult Owner's personnel.
 - 4. Recommend changes to cameras, lenses, and associated equipment to improve Owner's use of video surveillance system.
 - 5. Provide a written report of adjustments and recommendations.

3.06 CLEANING

- A. Clean installed items using methods and materials recommended in writing by manufacturer.
- B. Clean video-surveillance-system components, including camera-housing windows, lenses, and monitor screens.

3.07 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain video-surveillance equipment.

END OF SECTION 282500

SECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 QUALITY ASSURANCE

- A. Qualifications: Engage a licensed professional pest control operator, for application of soil treatment solution.
- B. Regulatory Requirements: Use only termiticides which bear a Federal registration number of the U.S. Environmental Protection Agency.
- C. Comply with FBC Section 1816 - Termite Protection.

1.03 JOB CONDITIONS

- A. Restrictions: Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.
- B. To ensure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of soil toxicant manufacturer.

1.04 SUBMITTALS

- A. Product Data: Treatments and application instructions, including EPA-Registered Label.
- B. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.

1.05 WARRANTY

- A. Provide 5 year written warranty from date of treatment, signed by Applicator and Contractor, certifying that applied soil termiticide treatment will prevent infestation of subterranean termites and, that if subterranean termite activity is discovered during warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation.

PART 2 - PRODUCTS

2.01 Materials

- A. Soil Treatment Solution: Use emulsible concentrate termiticide for dilution with water, specially formulated to prevent termite infestation. Provide a working solution of one of following chemical elements and concentrations.
 - A. Permethrin ("Dragnet", "Torpedo"); 0.5% in water emulsion.
 - B. Cypermethrin (APrevail FT@); 0.5% in water emulsion.
 - C. Imidacloprid ("Premise 75"); 0.1% water emulsion.
 - D. Fipronil (Termidor 80WG); 0.125% water emulsion.
- B. Other solutions may be used as recommended by Applicator if acceptable to local governing authorities and to Architect. Use only soil treatment solutions which are not injurious to planting.

SECTION 313116 – TERMITE CONTROL (continued):

PART 3 - EXECUTION

3.01 APPLICATION

- A. Surface Preparation: Remove foreign matter which could decrease effectiveness of treatment on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Termiticide may be applied before placement of compacted fill under slabs, if recommended by manufacturer.
- B. Application Rates: Apply soil treatment solution at rates recommended by soil termiticide manufacturer.
- C. Treatment Areas: Treat areas required by applicable codes. In addition, treat everything within one foot outside of building perimeter and as follows:
 - 1. Slabs-On-Grade: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 - 2. Foundations: Adjacent soil including soil along the entire inside perimeter of foundation walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, and piers; also, along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.

3.02 Post signs in areas of application warning workers that soil termiticide treatment has been applied. Remove signs when areas are covered by other construction.

3.03 Reapply soil termiticide treatment solution to areas disturbed by subsequent excavation or other construction activities following application.

END OF SECTION 313116